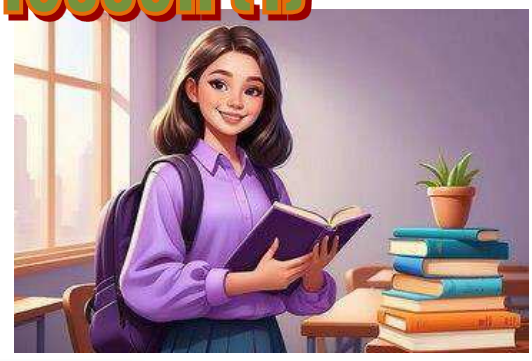
# Unit (1)
# Matter and energy
## lesson (1)
## States of matter



**Matter** is anything that has mass and occupies space

**The mass** is a fixed quantity that does not change from one place to another

## States and of Matter

Materials are classified according to their physical state into three common states

- Solid- Liquid - Gaseous -

## Properties of Matter

The properties of matter vary depending on their physical states,

### 1-The shape and ability to flow

| Solid | Liquid | Gaseous |
|---|---|---|
| 1-They do not flow and do not change shape;<br>2-they remain in a fixed, definite shape | 1- They Flow and change shape;<br>2-they take the shape o their container | 1- They Flow and change shape;<br>2-they take the shape .of their container |
| Wood- Iron | Water- Oil | Air -Oxygen |

figure (1)

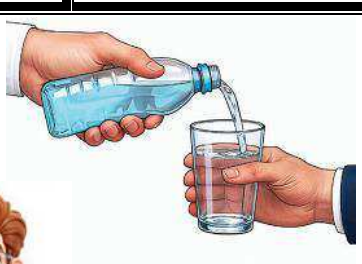


figure (2)

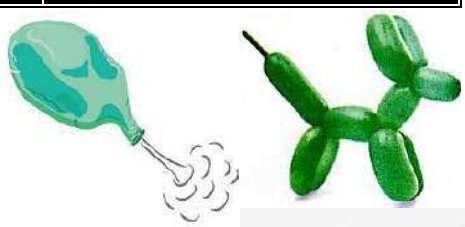


figure (3)

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We conclude that

Solids do not change shape when moved from one place to another

المواد الصلبة - لا يتغير شكلها عند نقلها من مكان إلى آخر.

Liquids and gases have the ability to flow, and their shape changes depending on the shape of their container

- السوائل والغازات تتمتع بالقدرة على التدفق، ويتغير شكلها تبعًا لشكل الوعاء الذي تحتويه.

Therefore, liquids and gases are classified into one group known as fluids

- لذلك، تُصنف السوائل والغازات ضمن مجموعة واحدة تُعرف باسم الموائع.

## Fluids

Materials that have the ability to flow and take the shape of their container.

الموائع المواد التي لديها القدرة على التدفق واتخاذ شكل الحاوية الخاصة بها.

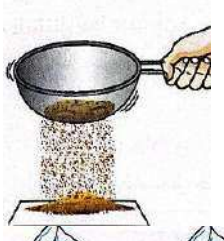
## Flow

The ability of fluids to flow easily

الانسياب قدرة السوائل على التدفق بسهولة

Liquids vary in their ability to flow according to their viscosity

Take care When flow occurs, the volume of the liquid does not change, while the volume of the gas change

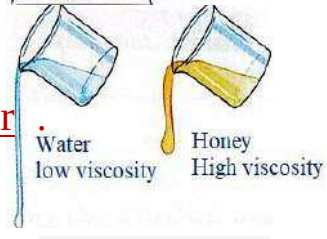


**G.R.** Why is the movement of sand not considered flow?

Because sand is not a fluid, and the transfer of the particles that make it up from one place to another does not change the shape of the grains

ج. ر. لماذا لا تُعتبر حركة الرمل تدفقًا؟

لأن الرمل ليس سائلًا، وانتقال جزيئاته من مكان لآخر لا يُغيّر شكل حبيباته.




**G.R.** The flow rate of Hony differs from the flow rate of water .

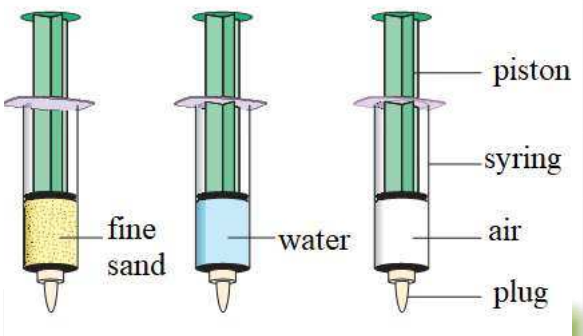
Because the viscosity of honey is greater than that of water, and the ability to flow is decrease with increasing viscosity

علل(ليه؟). يختلف معدل تدفق العسل عن معدل تدفق الماء.

لأن لزوجة العسل أكبر من لزوجة الماء، وتقل قدرته على التدفق مع زيادة اللزوجة.

## 2- Volume and compressibility

When the pistons of three syringes, whose opening are closed with a stopper, are pressed, they contain equal volumes of different materials .



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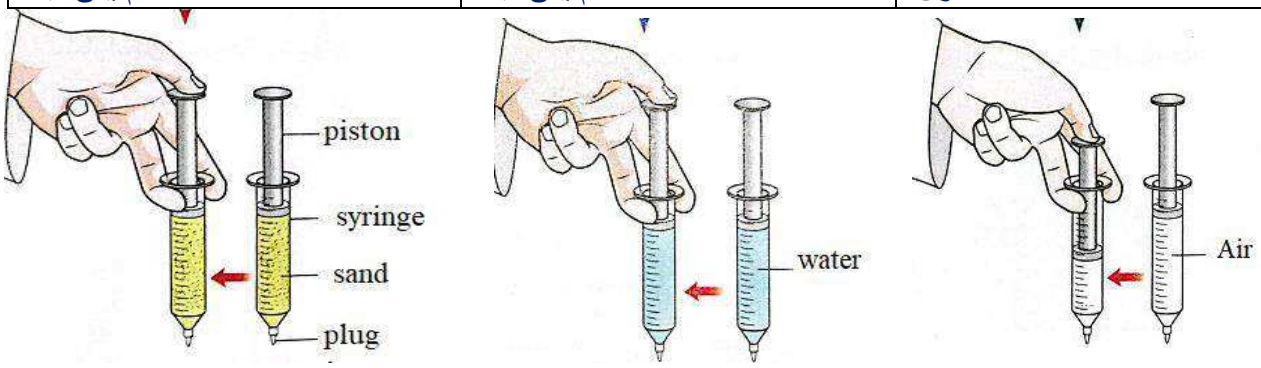
| Solid | Liquid | Gaseous |
|---|---|---|
| fine sand | Water | .air |
| Incompressible and their volume does not change. The volume remains .constant | Incompressible and their volume does not change The volume remains .constant | Compressed and their volume decreases to take the volume of the container containing them |
| غير قابلة للانضغاط، وحجمها لا يتغير. الحجم يبقى ثابتًا. | غير قابلة للانضغاط، وحجمها لا يتغير. الحجم يبقى ثابتًا. | قابلة للانضغاط، وحجمها يتغير. تاخذ حجم الاناء الحاوى. |




We conclude from the above that

-Solids and liquids have a fixed (definite) volume, and both are incompressible

-Gaseous substances do not have a fixed volume and are compressible

نستنتج أن- المواد الصلبة والسائلة لها حجم ثابت (محدد)، وكلاهما غير قابل للانضغاط. - المواد الغازية ليس لها حجم ثابت وقابلة للانضغاط

## Compressibility

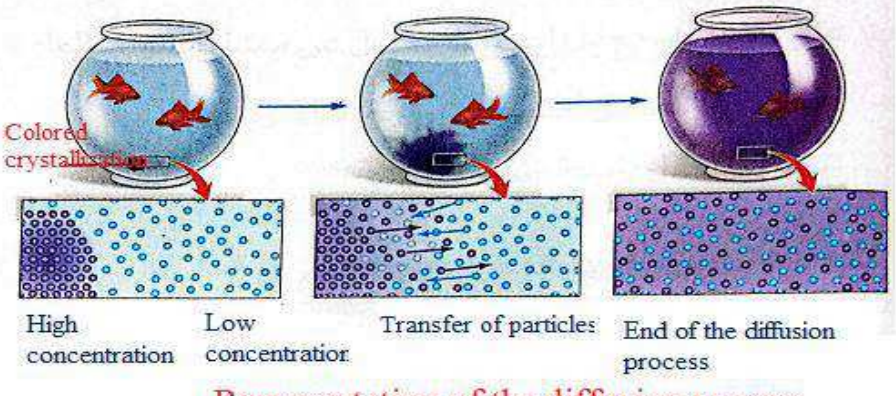
The ability to reduce the volume of gases when the pressure exerted on them increases

قابلية الانضغاط القدرة على تقليل حجم الغازات عند زيادة الضغط الواقع عليها

## 3- Diffusion Property

**Diffusion** The movement of particles of matter from high concentration medium to low concentration

حركة جزيئات المادة من وسط عالي التركيز إلى وسط منخفض التركيز




Representation of the diffusion process

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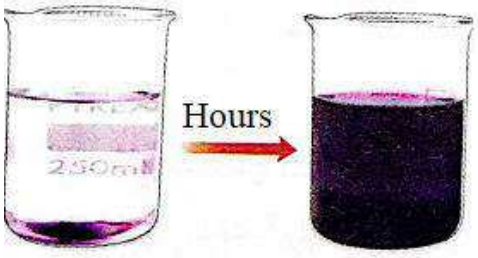
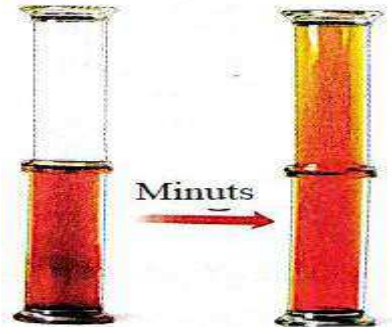
Diffusion occurs in

| Solid | Liquid | Gaseous |
|---|---|---|
| Very slow | Medium speed | Very fast |
| such as Diffusion of dye in a sponge | such as Diffusion of potassium permanganate in water | such as Diffusion of bromine vapors in air |




Diffusion occurs very quickly in gases, at an average speed in liquids, and very slowly in solids

يحدث الانتشار بسرعة كبيرة في الغازات، وبسرعة متوسطة في السوائل، وببطء شديد في المواد الصلبة.

| | Solid | Liquid | Gaseous |
|---|---|---|---|
| Changes shape with a change in its container | Does not change shape (its shape is fixed and definite | Changes shape takes the shape of its container | Changes shape takes the shape of its container |
| Ability to Flow | Non-flow-able | Flow-able, depending on its viscosity | Flow-able |
| Compressible | Incompressible | Incompressible | Compressible |
| Changes the volume by Compressible | Does not change volume (its volume is fixed and definite | Does not change volume (its volume is fixed and definite | Changes shape (takes the shape of its container |
| speed through it | Very slow | Average velocity | Very fast |

From Figure (6) Which of the following expresses what happened inside the bottle

A) Compression of air

B) Diffusion of air

C) Increase in air volume

D) Flow of air

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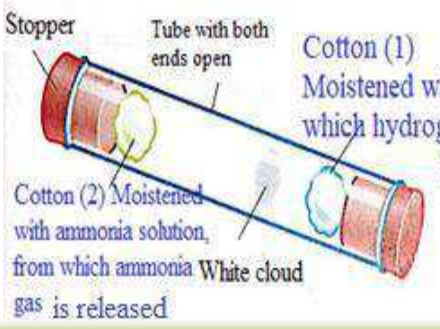
.Particles of matter are monatomic or polyatomic molecules
الجسيمات هي جزيئات أحادية أو متعددة الذرات.

A polyatomic molecule الجزيء متعدد الذرات
Consists of two or more atoms linked together by chemical bonds
يتكون من ذرتين أو أكثر مرتبطة ببعضها بروابط كيميائية.

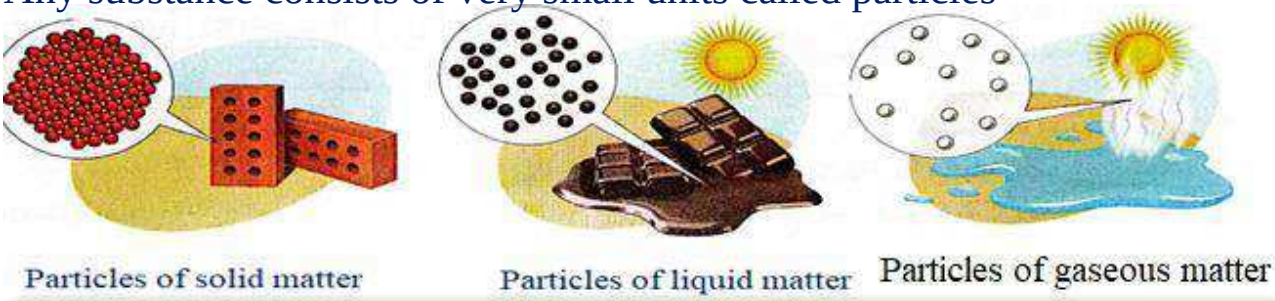

Stopper
Tube with both ends open
Cotton (1) Moistened with HCl acid, from which hydrogen chloride gas is released
Cotton (2) Moistened with ammonia solution, from which ammonia gas is released
White cloud

G. R. Ammonia gas diffuses faster than hydrogen chloride gas
Because their meeting point is near the cotton (1)
ينتشر غاز الأمونيا أسرع من غاز كلوريد الهيدروجين. لأن نقطة التقاءهما قريبة من القطن (1)

The mass of the hydrogen chloride molecule is greater than ammonia Because its diffusion rate is slower
كتلة جزيء كلوريد الهيدروجين أكبر من الأمونيا لأن معدل انتشاره أبطأ

## The particle model of matter النموذج الجسيمي للمادة

Any substance consists of very small units called particles




## Assumptions of the Particle Theory of Matter فروض نظرية الجسيمية للمادة

افتراضات نظرية الجسيمات للمادة:

1) Matter is made up of very small particles that they cannot be seen with the naked eye
1) تتكون المادة من جسيمات صغيرة جدًا لا تُرى بالعين المجردة.

2) Particles of the same matter are identical, and their type differs from one to another
2) جسيمات المادة نفسها متطابقة، ويختلف نوعها من مادة لأخرى.

3) There are attraction forces between the particles of matter, and the particles store potential energy due to the attractive forces between them
3) توجد قوى تجاذب بين جسيمات المادة، وتخزن الجسيمات طاقة كامنة نتيجةً لذلك.

4) There are molecular spaces between the particles of matter that vary depending on their physical state
4) تختلف المسافات البينية بين جسيمات المادة باختلاف حالتها الفيزيائية.

5) The particles that make up matter have kinetic energy, as they are in a state of continuous motion in straight lines.
5) تمتلك جسيمات المادة طاقة حركية، لأنها في حالة حركة مستمرة في خطوط مستقيمة

6) The method and speed of the particles' motion depending on the state of the matter
6-تختلف طريقة وسرعة حركة الجسيمات باختلاف حالة المادة.



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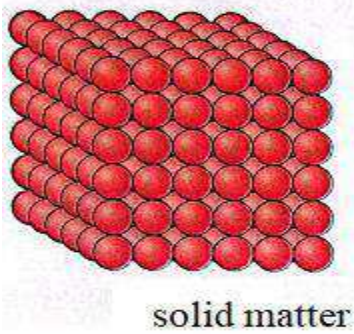
# Interpretation of the Properties of the States of Matter

## Behavior and Properties of Solids سلوك وخصائص المواد الصلبة


solid matter

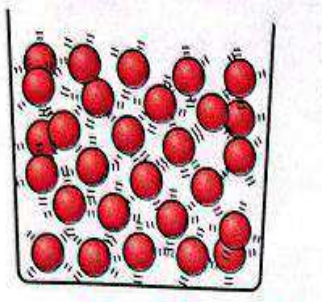
| Cause | Reason |
|---|---|
| The **attraction forces** between the particles are **very strong** | The particles of a solid are tightly bound together and have a fixed shape and do not flow |
| 1 قوى التجاذب بين الجسيمات قوية جدًا. | جسيمات المادة الصلبة مرتبطة ببعضها نيون ويكون لها شكل ثابت وغير قابل للانسياب |
| The **intermolecular space** between particles are **very small** | A solid has a **fixed volume** and is **incompressible** |
| المسافات البينية بين الجسيمات صغيرة جدًا. | المادة الصلبة لها حجم ثابت وغير قابلة للانضغاط |
| The particles **vibrate in its position** without moving to other positions | **Diffusion** through a solid is **very slow** |
| تهتز الجسيمات فى موضعها دون الانتقال إلى مواضع أخرى | الانتشار خلال المادة الصلبة يكون بطيء جدًا |

**G.R.** Solids have a definite shape and volume

Because the attraction forces between their particles are very strong and the intermolecular space between them are very small

المواد الصلبة لها شكل وحجم محددين، لأن قوى التجاذب بين جزيئاتها قوية جدًا والمسافات بينها صغيرة جدًا.

## Behavior and Properties of liquid سلوك وخصائص المواد السائلة


Liquid matter

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| Cause | Reason |
|---|---|
| The **attraction forces** between the particles are **relatively weak** but sufficient to hold them together | A liquid has **no fixed shape** and is **able to flow**, taking the shape of its container |
| قوى التجاذب بين الجسيمات ضعيفة نسبيا ولكنها كافية لتماسكها. | المادة السائلة ليس لها شكل ثابت وتكون قابلة للانسياب وتأخذ شكل الإناء الحاوى لها. |
| The **intermolecular space** between the particles are relatively large | A liquid has a **definite volume** and is **incompressible** |
| المسافات البينية بين الجسيمات كبيرة نسبيا. | المادة السائلة لها حجم محدد وتكون غير قابلة للانضغاط |
| The particles **move relatively freely** in their container | **Diffusion** through a liquid occurs at an **average speed** |
| تتحرك الجسيمات بحرية نسبيًا في الإناء الحاوى لها. | الانتشار خلال المادة السائلة يكون بسرعة متوسطة |

**G.R.** Liquids have an indefinite shape and a definite volume.

Because **the attractive forces** between their particles are **relatively weak** and **intermolecular space** between their particles are **relatively large**.

علل ؟ المواد السائلة لها شكل غير ثابت و حجم محدد. لأن قوى التجاذب بين جسيماتها ضعيفة نسبيًا والمسافات البينية بين جسيماتها كبيرة نسبيا .

## Behavior and Properties of gaseous سلوك وخصائص المواد الغازية

| Cause | Reason |
|---|---|
| The **attraction forces** between the particles are very weak. | gaseous substance has **no fixed shape** and is able to flow, taking the shape of its container |
| قوى التجاذب بين الجسيمات ضعيفة جدا. | المادة الغازية ليس لها شكل ثابت وتكون قابلة للانسياب وتأخذ شكل الإناء الحاوى لها |
| The **intermolecular space** between the particles are very large. | A gaseous substance has **no fixed volume,** is compressible - takes the shape of its container. |
| المسافات البينية بين الجسيمات كبيرة جدا. | المادة الغازية ليس لها حجم ثابت وتكون قابلة للانضغاط وتأخذ شكل الإناء الحاوى لها |
| The particles **move randomly and freely** in all directions | **Diffusion** through a gaseous substance is **very rapid** |
| تتحرك الجسيمات بطريقة عشوائية وبحرية تامة في جميع الاتجاهات | الانتشار خلال المادة الغازية يكون سريع جدا |


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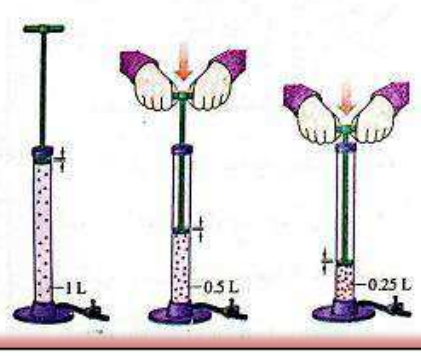
**G.R.** .Gaseous substances have no definite shape or volume

علل ؟ المواد الغازية ليس لها شكل أو حجم محددين.

Because the attraction forces between their particles are very weak, and the intermolecular space between them are very large

لأن قوى التجاذب بين جسيماتها ضعيفة جدا، والمسافات البينية بينها كبيرة جدا

**Compression of gases** reduces the **intermolecular space** their particles, which leads to a decrease in the volume of the gas, without changing the size of the particles




**The volume of gases decrease by compression**

## Brownian Motion الحركة البراونية

### Brownian Motion

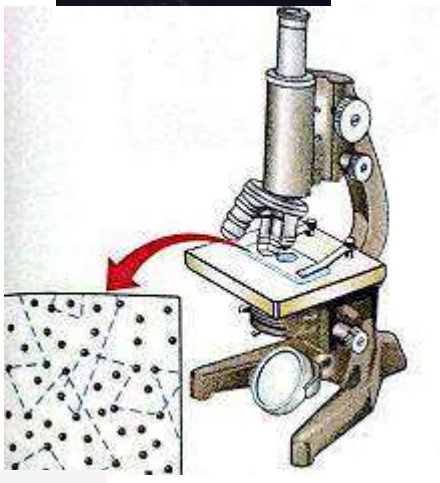
Random movement in all directions of relatively large particles suspended in a fluid as a result of their continuous collision with the particles of the fluid

الحركة البراونية الحركة العشوائية في جميع الاتجاهات للجزيئات الكبيرة نسبيا المعلقة في مائع نتيجة لتصادمها المستمر مع جزيئات المائع

Its Discovery

In 1827, the scientist Brown discovered that pollen grains suspended in water are in a state of continuous random motion in all directions. This motion was named Brownian motion after the scientist Brown

اكتشافها : اكتشف العالم براون عام 1827 أن حبوب اللقاح المعلقة في الماء ، تكون في حالة حركة عشوائية مستمرة في جميع الاتجاهات وسميت هذه الحركة بالحركة البراونية نسبة إلى العالم براون.



Its Cause

Collision between the particles of a liquid or gas and the relatively large particles present in it, such as pollen grains in water or dust in the air, which leads to the random movement of the pollen or dust grains in all directions.

سبب حدوثها : التصادم بين جزيئات المائع السائل أو الغاز والجزيئات الكبيرة نسبيا الموجودة فيه كحبوب اللقاح في الماء أو الغبار في الهواء، مما يؤدى إلى حركة حبوب اللقاح أو الغبار بشكل عشوائي في جميع الاتجاهات.

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| Solid | Liquid | Gaseous |
|---|---|---|
| 1-G.R.The difficulty of breaking a piece of rock | 2- G.R.dissolving a quantity of table salt in water | 3- G.R.The reason for the spread of smoke from a candle wick in the air |
| 1- صعوبة كسر قطعة من الصخر؛ | ٢- إذابة كمية من ملح الطعام في الماء | ٣- سبب انتشار دخان فتيل الشمعة في الهواء |
| Because rock is a solid matter, and its particles are bound by very strong attraction forces, and the intermolecular space between them are small, and they only move | Because water is a liquid matter, and its particles can penetrate between the salt particles and break the bonds between its molecules, leading to dissolution | Because air is a gas, and its particles are separated and move freely and quickly, allowing smoke (which is a gaseous matter or small particles) to spread quickly in all directions |
| لأن الصخر مادة صلبة، وجزيئاتها مترابطة بقوى تجاذب قوية جدًا، والمسافات بينها صغيرة، تتحرك فقط | لأن الماء مادة سائلة، وتستطيع جزيئاته اختراق جزيئات الملح وكسر الروابط بينها، مما يؤدي إلى ذوبانها. | لأن الهواء غاز، وجزيئاته منفصلة وتتحرك بحرية وسرعة، مما يسمح للدخان (وهو مادة غازية أو جزيئات صغيرة) بالانتشار بسرعة في جميع الاتجاهات |

| | Solid | Liquid | Gaseous |
|---|---|---|---|
| Attraction force between molecules | Very strong | Relatively weak | Very weak |
| Behavior resulting from the property | It has a fixed shape but does not take the shape of its container and is not able to flow | It has an irregular shape (, takes the shape of its container and is able to flow). | It has an irregular shape (ttakes the shape of its container and is able to flow). |
| The distances between them | Very small | Relatively large | Very large |
| Behavior resulting from the property | They have a constant volume and are incompressible | They have a constant volume and are incompressible | They have an inconstant volume and are compressible |
| The movement of the particles | The particles stay in position only | The particles move relatively locally | The particles move freely randomly |
| Behavior resulting from the property | Diffusion through them is very slow | Diffusion through them is at an average speed | Diffusion through them is very fast |


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# Plasma State

## Plasma State

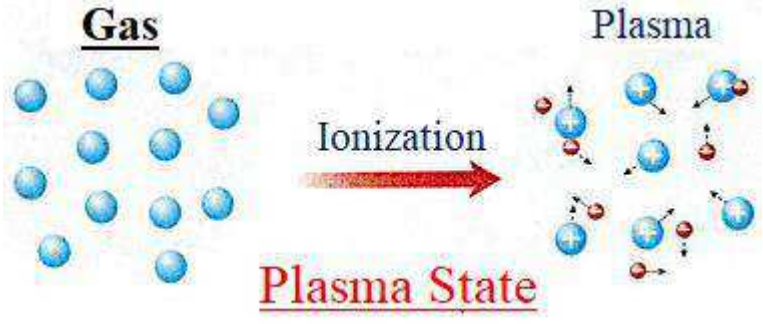
The fourth state of matter, in which gases exist - in the form of a mixture of positively charged ions and negatively charged free electrons

حالة البلازما الحالة الرابعة للمادة والتي تكون فيها الغازات -على هيئة خليط من أيونات موجبة الشحنة والكترونات حرة سالبة.

## When does plasma occur?

When gases are heated very intensely (thousands or millions of degrees), they ionize, i.e., they turn into positively charged ions and negatively charged free electrons. This state is known as plasma, and it is considered the fourth state of matter

متى تحدث البلازما عند التسخين الشديد جدا للغازات (آلاف أو ملايين درجات الحرارة) فإنها تتأين ، أى تتحول إلى أيونات موجبة الشحنة والكترونات حرة سالبة الشحنة وتعرف هذه الحالة بالبلازما وهي تعد الحالة الرابعة من حالات المادة.



## Characteristics of the plasma state مميزات حالة البلازما

Its high electrical conductivity توصيليتها الكهربية المرتفعة

## Forms of its existence صور تواجدها

1-Matter in outer space exists in the plasma state, such as in the sun, stars, and cosmic nebulae

2-Lightning 3-Aurora Borealis

1) المادة في الفضاء الخارجى توجد فى حالة البلازما، كما في الشمس والنجوم والسديم الكونى.
2) البرق.
3) الشفق القطبي (الأورورا )

## Technological Application

The plasma state is used in air conditioning systems to improve indoor air quality, as gases are passed through a high electric field to convert their atoms into positively charged ions and negatively charged electrons. The charged gas ions work to break down harmful air pollutant molecules, germs, and viruses, The result which leads to cleaner air

يتم استخدام حالة البلازما في أنظمة تكييف الهواء لتحسين جودة الهواء الداخلي، حيث تمر الغازات عبر مجال كهربائي عالي لتحويل ذراتها إلى أيونات موجبة الشحنة وإلكترونات سالبة الشحنة. تعمل أيونات الغاز المشحونة على تكسير جزيئات الملوثات الضارة للهواء والجراثيم والفيروسات، مما يؤدي إلى هواء أنظف.



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Objective questions

## Unit One, Lesson (1)

Questions
UNIT 1 | Lesson 1

### 1- Write Scientific term

1-Everything that has mass and occupies space (……)
2-Materials that have the ability to flow and take the shape of their containing container (……)
3-The ability of fluids to flow easily (……)
4-The possibility of reducing the volume of gases when the pressure exerted on them increases (……)
5-The movement of particles of matter from an area of high concentration to an area of low concentration (……)
6-The random movement in all directions of relatively large molecules suspended in a fluid as a result of their continuous collision with the fluid particles (……)
7-The fourth state of matter (……)
8-The state in which gases are a mixture of positively charged ions and negatively charged free electrons (……)

### 2-Complete the following sentences with appropriate words

1-…….Materials can flow and be compressed, while …….materials can flow and are incompressible
2-Diffusion through…… is very fast, while diffusion through……. the medium is very slow
3-The speed of diffusion of the particles of matter depends on…….. the medium and ……..particles
4-The theory……. succeeded in explaining much of the behavior of matter
5-The particles of a one material is…… But they …… from one material to another
6-The particles of matter have ……energy. Due to their constant movement, they have energy. Due to the forces of attraction
7-The distances between iron molecules are ……., while the distances between hydrogen molecules are……..,
8- The attractive forces between particles are greatest in materials……., and almost non-existent in……., materials
9- The ……..scientist discovered the random movement of particles suspended in fluids, which is known as……..
10-Brownian motion occurs as a result of collisions between……..and……
11-When gases pass through a high electric field, their atoms turn into……..
12-Most of the matter in outer space exists in a …….state of……. as in
13-In air conditioning systems, charged gas ions act on…….. harmful air pollutant molecules which makes the air……..


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## 3-Correct the underlined words

1-The flow of liquids varies according to their density
2-When flow occurs, the volume of the gas does not change, while the volume of the solid change
3- Liquids do not have a definite shape or volume
4-Solids have the ability to flow but not the ability to be compressed
5-The speed of diffusion through solids is equal to the speed of diffusion through gases
6-The spacing between the particles of liquids is equal to the spacing between the particles of gases
7-Particles suspended in solids move randomly, known as Brownian motion

## 4-Put (√ ) and (X) and correct the wrong

1-The mass of matter is a variable quantity from one place to another ( )
2-Solids and liquids are called fluids ( )
3-The shape of a fluid changes depending on the shape of the path it moves in ( )
4-The ability of fluids to flow increases with increasing viscosity
5-The speed of diffusion increases with increasing temperature of the diffusion medium ( )
6-The speed of diffusion of $H_2$ gas differs from the speed of diffusion of $O_2$ gas( )
7-The particles of a single substance are different from each other( )
8-The spacing between the particles of a substance varies depending on its physical state ( )
9-The particles of a substance are in a state of constant motion ( ) ( )
10-The forces of attraction between the particles of solids are almost nonexistent
11-The forces of attraction between water molecules are weak, while between air molecules they are minimal ( )
12-The movement of particles in gaseous materials is limited ( )
13-Environmental distances in the case of liquids are considered intermediate between solids and gases ( )
14-The materials that make up the sun and stars are found in the gaseous state ( )

## 2.Choose the correct answer:

1-Each of the following is a substance, except

Empty basket
(a)

Musical notes
(b)

Snow (Ice)
(c)

Uninflated balloon
(d)

2-Which of the following substances are flow-able

a. Wood and oil b. Wood and iron c. Water and oxygen d. Iron and air


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3- Which of the following materials are considered fluids

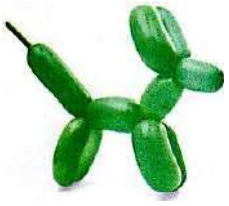
a. Ice and liquid water b. Iron and water vapor

c. Oil and iron d. Water vapor and liquid water

4-Which of the following has a definite shape

a. Air b. Oil c. Ice d. Water

5-The opposite figure shows a long balloon inflated with air, shaped like a dog



Which of the following can be concluded about air

a. It has no mass b. It has a definite volume

c. It has no definite shape d. It does not occupy space

6-A solid is characterized by

a. It has no fixed volume or shape

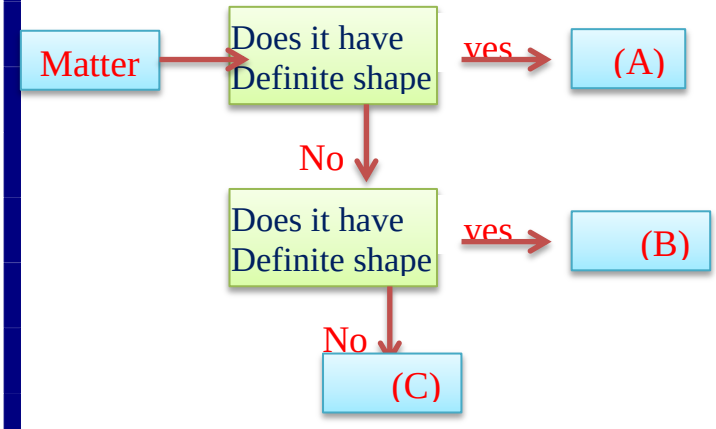
b. It has a fixed volume and shape

c. it has a fixed shape and a non-fixed volume

d. It has a fixed volume and a non-fixed shape

7- From the flow chart opposite

What do (A), (B), (C) express




| Choice | (A) | (B) | (C) |
|---|---|---|---|
| a | Sand | Air | Honey |
| b | Oil | Sand | Ice |
| c | Sand | Honey | Air |
| d | Ice | Air | Oil |

(8) The common property between solids and liquids is that both of them

a. Fixed size volume b. flow-able c. Fixed shape d. Compressible

9-Both water and air have their own

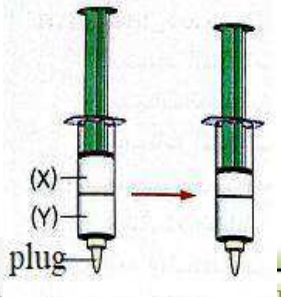
a. Mass b. Specific shape c. specific volume c. The same particles

10-Compression of matter means

a. Transform it from one state to another b. changes in mass

c. reduce its volume d. Change in the volume of its particles

(11) In the opposite figure




Which of the following represents both (X) and (Y)

a. (X) Air (X) Water b. (X) Water (X) Air

c. (X) Sand (X) Water d. (X) Air (X) Air



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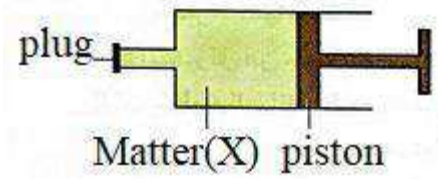
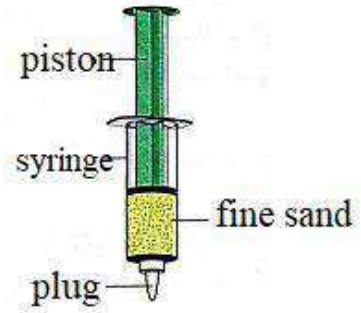
12-In the opposite figure
When the piston is pressed, the volume of the substance (X) does not change Which of the .following represents the substance (X)




a. A liquid substance, because it does not have a definite volume
b. A liquid substance, because it has a definite volume
c. A gaseous substance, because it cannot be compressed
d. A gaseous substance, because it can be compressed

13-In the opposite figure The piston does not move when pressed Because the sand




a. has an indefinite shape b. is non-flow-able
c. has an indefinite volume d. is incompressible

14-The movement of particles of a substance at great speed from an area of high concentration to another area of lower concentration represents the process
a. Liquid melting b. Solid melting
c. Diffusion of a substance in a liquid d. Diffusion of a substance in a gas

15-Particles of matter cannot be seen with the naked eye because they are
a. Very small b. Vibrate c. Move freely d. Move randomly

16-Why does water flow from a full cup to the brim when ice cubes are added to it Because
a. Ice has a definite volume b. Ice has an indefinite shape
c. Water has an indefinite volume d. Water exists in different states

(17) All of the following are true regarding the particle theory of matter, except
a. The particles of solid matter are subject to a force of attraction between them
b. The particles of gases move randomly in straight lines
c. The particles of liquid matter have spaces between them
d. The particles of any material that can be seen with the naked eye

18-It is difficult to bend an iron rod because
a. Its compressibility b. Its ability to flow
c. The lack of spaces between its molecules
d. The intensity of the attractive forces between its molecules

19- What happens to a piece of material when the spaces between the molecular structures of its particles increase
a. Only its volume changes b. Only its shape changes
c. Both its volume and shape change d. Neither its size nor shape changes

20- Liquid materials are characterized by the following properties, except
a.Its molecules move in Brownian motion



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b. The molecules diffuse through it at an average speed
c. It takes the shape of its container. d. compressibility

21-Gases diffuse throughout the available space because they are compressible
a. The forces of attraction between their molecules are very strong
b. The forces of attraction between their molecules are almost non-existent
c. The distances between their molecules are relatively large
d. The distances between their molecules are as smallest

22-The distances between them are as large as possible between molecules
a. Iron b. oxygen c. water d. oil

23-The movement of gas molecules is
a. circular b. vibrational c. random d. wavelike

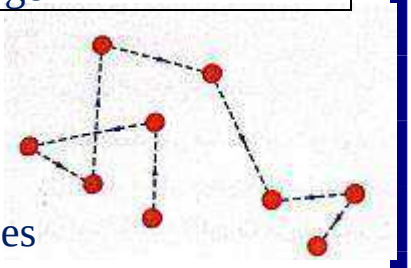
24-When comparing water molecules to oxygen molecules, water molecules are
a. slower and further from each other b. faster and closer together than each other
c. slower and closer together than each other d. faster and further from each other

25-Which of the following represents the correct arrangement of substances, according to the forces of attraction between their particles
a. Oil < oxygen) < wood b. Wood < oxygen< oil
c. Oxygen < wood< oil d. Oxygen < oil < wood

26-Which of the following is true

| Choice | Its volume is fixed and its shape is not fixed | The attraction forces between its molecules are very large | The movement of its molecules are completely free |
|---|---|---|---|
| a | Carbon dioxide | Oxygen | Oil |
| b | Aluminum | Alcohol | Water vapour |
| c | Oil | Iron | Alcohol |
| d | Alcohol | Ice | Oxygen |

27-From the opposite figure: What is the reason for the movement of a pollen grain suspended in still water in this way



a. It is a self-moving living cell
b. It is affected by successive collisions with water molecules
c. The density of its matter is greater than the density of water
d. The density of its matter is less than the density of water

## 3.Choose the odd word (or phrase) from the following,

1-Oil / Alcohol / Water / Carbon dioxide
2-Oxygen / Hydrogen / Ammonia / Wood
3-Flowable / Compressible / Slow to diffuse / No definite shape
4- Has a fixed volume / Flowable / Incompressible / Has a fixed shape



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5-Its particles move in a vibratory motion / The forces of attraction between its particles are as great as possible / The distances between its particles are as small as possible / Non-diffusionable

## Essay Questions

### 1-What is meant by each of

1-Matter 2-Fluid
3-Flow 5-Compressibility
5-Diffusion 6-Brownian motion
7- Plasma state

### 2-Give reasons for the following

1- Naming liquids and gases as fluids

……

2- The difference between the flow rate of honey and the flow rate of water

……

3- Solids have a definite shape and volume

……

4- Liquids have an indefinite shape and a definite volume

……

5-Gaseous substances have neither a definite shape nor a definite volume

……

6-The ability of gaseous substances to compressibility

……

7-The spread of perfume in the room when the perfume bottle is left open

……

8-Water gradually turns purple when a potassium permanganate crystal is placed in it

……

9-Gases have a great ability to diffuse

……

10-A solid retains its shape regardless of the shape of its container, while a liquid takes the shape of its container

……

11-It is easy to divide a quantity of water into small parts

……

12-It is difficult to break a piece of rock

……


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13-The solubility of table salt in water

……

14-The diffusion of a candle in air

……

## 3-What do you notice when

1- Pressing the plunger of a closed syringe with a quantity of air

……

2-Pressing a closed empty plastic bottle

……

3-Adding a few crystals of potassium permanganate to a beaker containing a quantity of water

……

3-Opening a bottle of ammonia in a corner of a room

……

5-Stirring a spoonful of sugar into a cup of water

……

6-Extreme heating of gases in research laboratories

……

## 4-Compare each of

1-Solid, liquid, and gaseous substances in terms of: flowability, compressibility, and diffusibility

2-Iron, oil, and oxygen in terms of: change in shape when the container is changed, change in volume when compressed

3-Ice, water, and water vapor in terms of: particle movement, distances between them, and forces of attraction between particles

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تغير الحالة الفيزيائية للمادة

# lesson (2) Change in the physical state of matter

*The following diagram shows what happens to water in its three states when it gains thermal energy:

المخطط التالي يوضح ما يحدث للماء بحالاته الثلاث عند اكتساب طاقة حرارية

1) When ice gains a quantity of thermal energy the kinetic energy of its particles increases, leading to an increase in the temperature of the ice.

عند اكتساب الثلج كمية من الطاقة الحرارية تزداد طاقة حركة جسيماته . مما يؤدى إلى رفع درجة حرارة الثلج

*With the continued gainin of more thermal energy

مع استمرار اكتساب المزيد من الطاقة الحرارية

2)The force of attraction between the particles weakens, and at the melting point (0°C), the ice turns into water, and the temperature of the ice and water remains constant until they melt completely.

تضعف قوة التجاذب بين الجسيمات، وعند درجة الانصهار(0°C) يتحول الثلج إلى ماء وتظل درجة الحرارة ثابتة للثلج والماء حتى تمام الانصهار

*With the continued gainin of more thermal energy

مع استمرار اكتساب المزيد من الطاقة الحرارية

The kinetic energy of the ter particles increases, ding to a gradual increase the temperature of the wat il it reaches the boiling int (100°C).

تزداد طاقة حركة جسيمات الماء مما يؤدى إلى ارتفاع درجة حرارة الماء تدريجيا حتى تصل إلى درجة الغليان (100°C)

*With the continued gai of more thermal energy

ستمرار اكتساب المزيد من الطاقة الحرارية

4)The forces of attraction between the particles weaken, and the temperature of water and steam remains constant at (100°C) until the evaporation process is complete

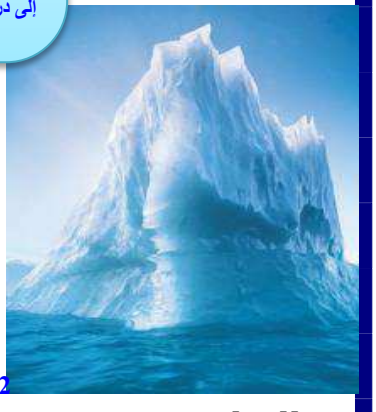
يزداد ضعف قوى التجاذب بين الجسيمات وتظل درجة الحرارة ثابتة للماء والبخار عند (100°C) حتى تمام عملية التبخر

## In general, it is noted that

وبشكل عام يلاحظ أن

1) When a substance in one of its states gains thermal energy, the kinetic energy of its particles increases Its temperature increases, and vice versa.

1) عند اكتساب المادة في أحد حالاتها طاقة حرارية، تزداد طاقة حركة جسيماتها تزداد درجة حرارتها، والعكس صحيح



2) As the liquid continues to gain more thermal energy, its temperature gradually rises until it reaches the boiling point.

2) عند استمرار اكتساب المادة السائلة للمزيد من الطاقة الحرارية ، ترتفع درجة حرارتها تدريجيا حتى تصل إلى درجة الغليان.

3) As the liquid substance continues to lose thermal energy, its temperature gradually decreases until it reaches the freezing point.

3) عند استمرار فقد المادة السائلة للطاقة الحرارية، تنخفض درجة حرارتها تدريجيا حتى تصل إلى درجة التجمد

4) During the processes of melting and boiling, the temperature remains constant, as the absorbed thermal energy weakens the attractive forces between the particles (molecules) of the substance.

4) أثناء عمليتي الانصهار و الغليان ، تظل درجة الحرارة ثابتة ، حيث تعمل الطاقة الحرارية الممتصة على إضعاف قوى التجاذب بين جسيمات ( جزيئات ) المادة .

Give reason



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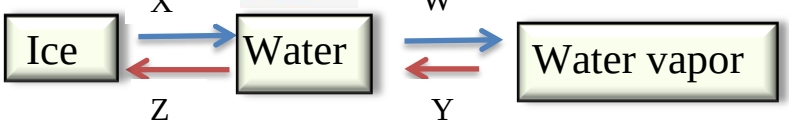
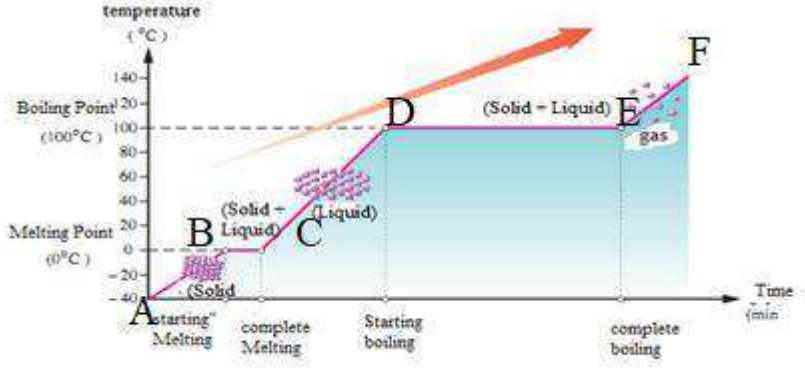
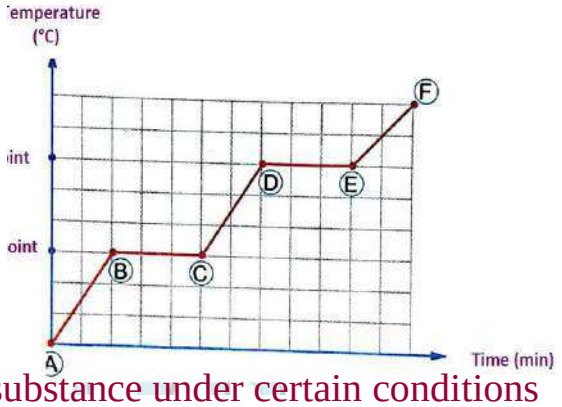
Identify the symbol for each of the two processes in which the energy of the particles of the substance increases.




A: The increase in the energy of the particles leads to an increase in the temperature of both ice and water, as occurs in the processes of melting and boiling (evaporation)

*The energy of the particles increases in both processes (Z), (Y).




Graphical representation of the heating curve of the substance under certain conditions

Analysis of the graph data:

| Period - | Analysis |
|---|---|
| AB | 1)An increase in temperature occurs from: A to B<br>2)The matter is in the solid state.<br>تكون المادة في الحالة الصلبة<br>3)The particles of the solid substance vibrate more in position, as a result of gaining thermal energy , Which leads to an increase in its kinetic energy.<br>تهتز جسيمات المادة الصلبة أكثر فى موضعها ، نتيجة اكتساب الطاقة الحرارية وهو ما يؤدى إلى زيادة طاقة حركتها |
| BC | 1) No change in temperature occurs from: B to C, because the absorbed thermal energy is consumed in weakening the attraction forces between the particles of the solid until it completely transforms into the liquid state.<br>لا يحدث تغير في درجة الحرارة من B: C ، لأن الطاقة الحرارية الممتصة تستهلك في إضعاف قوى التجاذب بين جسيمات المادة الصلبة حتى تتحول بالكامل إلى الحالة السائلة.<br>2) The matter is in both the solid and liquid states.<br>3) Point B or C represents the melting point of the substance.<br>٢) تكون المادة في الحالتين الصلبة والسائلة. ٣) تمثل النقطة B أو C درجة انصهار المادة. |
| C D | 1) A rise in temperature occurs from: C: D<br>2) The matter is in the liquid state.<br>3) The speed of the particles of the liquid substance increases, as a result of gaining thermal energy which leads to an increase in their kinetic energy.<br>١) يحدث ارتفاع في درجة الحرارة من: ج: د ٢) تكون المادة في الحالة السائلة<br>٣) تزداد سرعة جسيمات المادة السائلة نتيجة اكتسابها طاقة حرارية مما يؤدي إلى زيادة طاقتها الحركية. |



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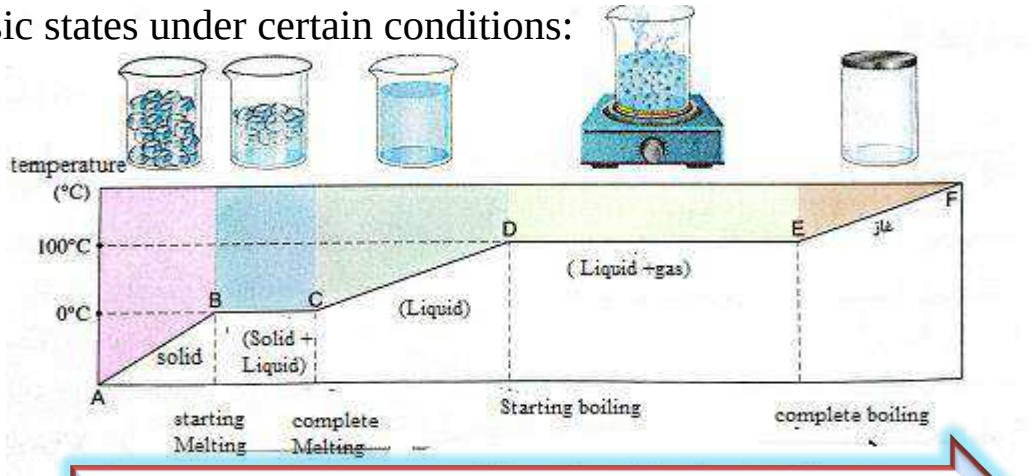
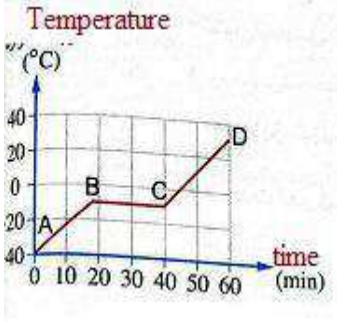
| | |
|---|---|
| DE | 1) No change in temperature occurs from D:E , because the absorbed thermal energy is consumed in weakening the attraction forces between the particles of the liquid substance until it completely transforms into the gaseous state.<br>لا يحدث تغير في درجة الحرارة من : ، لأن الطاقة الحرارية الممتصة تستهلك في إضعاف.<br>قوى التجاذب بين جسيمات المادة السائلة حتى تتحول بالكامل إلى الحالة الغازية.<br>2)The matter is in both the liquid and gaseous states.<br>تكون المادة في الحالتين السائلة والغازية.<br>3)Point (D) represents the boiling point of the substance.<br>3) النقطة (د) تمثل نقطة غليان المادة |
| EF | 1)A rise in temperature occurs from:<br>2) The matter is in the gaseous state.<br>3) The speed of the particles of the gaseous substance increases, as a result of gaining thermal energy which leads to an increase in their kinetic energy.<br>١) يحدث ارتفاع درجة الحرارة نتيجة: ٢) وجود المادة في الحالة الغازية.<br>٣) تزداد سرعة جسيمات المادة الغازية نتيجة اكتسابها طاقة حرارية، مما يؤدي إلى زيادة طاقتها الحركية. |

Application Graphical representation of the heating curve of water in its three basic states under certain conditions:




**Increase in the amount of absorbed heat over time**

Heating curve of water in its three basic states




(Q1) The graph opposite shows the heating curve of a solid (X):

1)What is the approximate temperature at which a change in state of matter occurs?

A) -30°C B)-10°C C)0°C D)18°C

(2) What happens to the kinetic energy of the particles of the substance (X) in the interval BC? With an explanation.

Answer (1). The substance is in the solid state from -40°C to -10°C, and in the liquid state from -10°C to 30°C. A change in state of matter occurs at a temperature of 100°C.Therefore, the correct choice is B

(2) The kinetic energy of the particles of the substance (X) does not change during the interval BC, because there is no change in temperature.

(Q2)) The table opposite shows the boiling and melting points of the three pure substances (Y), (X), (Z). State the physical states of these substances at 100 °C With explanation.

| Substance (X) | Y | Z |
|---|---|---|
| boiling points 84 °C | 125 °C | 315 °C |
| melting points 5 °C | 25 °C | 102 °C |



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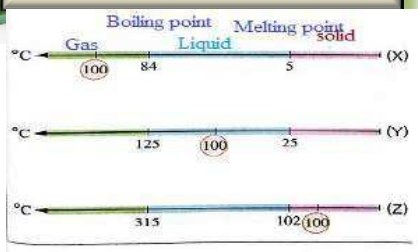
Because : Substance (X) melting and boiling points less than 100 °C
So : Substance (X) is in the gaseous state.
Because Substance (Y) melting point is less than 100 °C
and its boiling point is greater than 100 °C
So Substance (Y) is in the liquid state.
Because Substance (Z) melting and boiling points greater than 100 °C
So Substance (Z) is in the solid state.

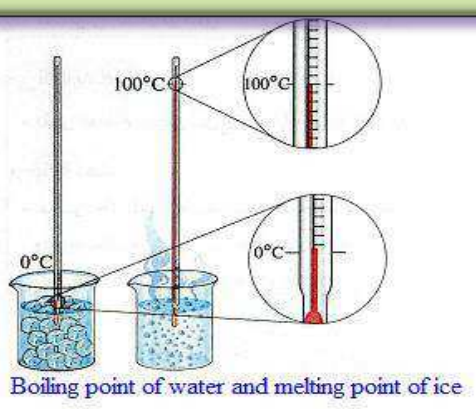



## The factors Affecting the Melting and Boiling Points of matter?
العوامل المؤثرة على درجتي انصهار وغليان المواد

Every pure substance has two fixed values for the melting and boiling points at normal atmospheric pressure.
لكل مادة نقية قيمتين ثابتتين لدرجتى الانصهار والغليان عند الضغط الجوى المعتاد
These values are affected by several factors, including:
1) Atmospheric pressure 2)Degree of purity of matter
وتتأثر هاتين القيمتين بعدة عوامل ، منها 1) الضغط الجوي 2) درجة نقاء المادة :

### 1) The relation between Atmospheric pressure and melting and boiling points
العلاقة بين الضغط الجوى و درجتى الانصهار والغليان

A) At sea level the atmospheric pressure is normal atmospheric pressure , in which :-
عند مستوى سطح البحر ضغط الهواء الجوى هوالضغط الجوي المعتاد، وعنده تكون
1) Melting point of ice 0°C
2) Boiling point of water 100 °C

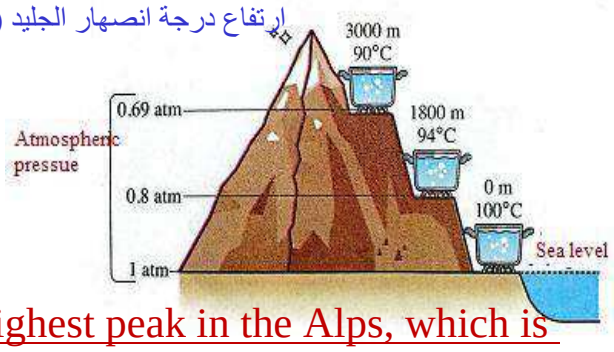


Boiling point of water and melting point of ice

B) As we move above the sea level surface atmospheric pressure decrease
كلما ارتفعنا لأعلى فوق مستوى سطح البحر ينخفض الضغط الجوى عن الضغط الجوى المعتاد ويترتب على ذلك
So that 1)boiling point decrease that 100 °C , by 1 °C for each 300 m height
انخفاض درجة غليان الماء عن 100 حيث تنخفض درجة الحرارة حوالى I°C تقريبا لكل 300 ارتفاع.
2) Increase melting point of ice than 0°C and vice versa
ارتفاع درجة انصهار الجليد ( تجمد الماء) عن0 والعكس صحيح

### Application :-

1)The decrease of atmospheric pressure in mountain areas causes decrease of the boiling point of pure water than 100 °C
2) As the height increase boiling point decrease.




Q: What is the boiling point of water at the highest peak in the Alps, which is approximately 4800?
The temperature decreases by 1 for every 300 degrees of altitude.
The amount of temperature decrease = $\frac{4800}{300}$ = 16 °C
The boiling point of water at the highest peak in the Alps - 100 - 16 = 84°C



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## Technological Application: The Pressure cooker
تطبيق تكنولوجي (حلة الضغط)

### Its Importance أهميته

- Cooking food in less time compared to cooking in a regular pot to save fuel energy.
طهي الطعام في زمن أقل مقارنة بالطهي في القدر المعتاد لتوفير الوقود (الطاقة.

### Pressure cooker idea فكرة حلة الضغط

Trapping water vapor inside it during the cooking process, which leads to an increase in pressure and thus raising the boiling point of water above 100. This reduces the cooking time and helps save fuel.

حبس بخار الماء داخله أثناء عملية الطهي، مما يؤدى إلى زيادة الضغط وبالتالي ارتفاع درجة غليان الماء عن 100 . وهو ما يقلل من زمن طهي الطعام ويساعد على توفير الوقود

Normal pot

70:90%

Pressure pot
Save energy

## 2 - The relationship between the **purity of matter** and its **boiling** and **freezing** points (**melting**)
**العلاقة بين درجة نقاء المادة ودرجتى الغليان والتجمد (الانصهار )**

1-Impurities affect the attraction forces between particles of the pure substance
1- تؤثر الشوائب على قوى التجاذب بين جزيئات المادة

2) leading to a change in the amount of energy required to change its state
مما يؤدى إلى تغير كمية الطاقة اللازمة لتغيير حالتها المادة النقية

3) and thus change both its Melting and boiling points
ويتبع ذلك تغير كل من در جة انصهار وغليانها

4) Therefore, the purity of substances is checked by comparing their boiling or melting points to their constant values when they are in the pure state
**لذا يتم التحقق من مدى نقاء المواد بمقارنة درجة غليانها أو درجة انصهارها بالقيم الثابتة لها وهى في الحالة النقية**

### Mathematical understanding: فهم رياضياتي:

The amount of elevation in the boiling point of a solution and the depression in its freezing point depend on its concentration.
يتوقف مقدار الارتفاع في درجة غليان المحلول، والانخفاض في درجة تجمده على تركيزه.



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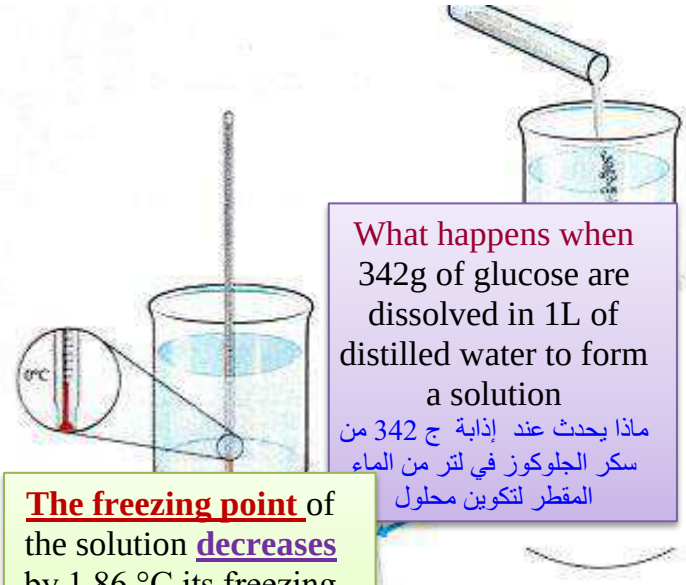
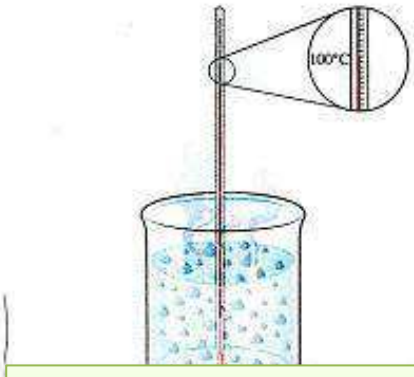


What happens when 342g of glucose are dissolved in 1L of distilled water to form a solution

ماذا يحدث عند إذابة 342 ج من سكر الجلوكوز في لتر من الماء المقطر لتكوين محلول

**The freezing point** of the solution **decreases** by 1.86 °C its freezing point becomes (-1.86 °C

تنخفض درجة تجمد المحلول بمقدار C 1.86



**The boiling point increases**, i.e., it becomes the solution by 0.5 C its boiling point becomes 100.5 C

ترتفع درجة غليان أي تصبح المحلول بمقدار C 0.5

*Boiling point rise and freezing point fall when glucose is dissolved in distilled water.

ارتفاع درجة الغليان وانخفاض درجة التجمد عند إذابة سكر الجلوكوز في الماء المقطر

## Evaluation?

(1) Complete the blanks of the following statements with appropriate words:

(1) When a substance gains thermal energy, the energy of increases……. its particles, leading to a rise……...

(2) When atmospheric pressure increases……., the boiling point of a liquid is its …… .freezing point

(3) The temperatures of the two states of a substance……..and…… are the same.at the boiling point.

(4) At normal atmospheric pressure, the boiling point of pure water is…… …and its melting point is.....

(B) From the opposite diagram

Ice ⇄ Water ⇄ Water vapor

(D) (C) (A) (B)

Identify the symbols and names of each of the following:

(1) Processes that take place by gaining thermal energy.

(2) Processes that take place by losing thermal energy.

(1) Correct the underlined part:

(1) The boiling point of water decreases by 10°C for every 300 mm rise.

(2) The boiling point of a glucose solution depends on its mass.

(3) The kinetic energy of the molecules of a liquid substance is very large.

(4) A normal saucepan helps save energy during cooking

(b) From the heating curve shown in the figure opposite:



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# *Matter Transformations: Reversible Processes

تحولات المادة عمليات انعكاسية

## 1) Condensation of Water Vapor:

Water vapor in the air condenses into water droplets on the cold outer surface of a glass containing ice cubes due to the loss of heat energy.

تكثف بخار الماء يتكثف بخار ماء الهواء الجوي في صورة قطرات مائية على السطح الخارجي البارد لكوب زجاجي به قطع ثلج نتيجة فقدانه طاقة حرارية

## 2)Evaporation of Water

Water evaporates into water vapor due to gain of heat energy by heating.

تبخر الماء يتصاعد الماء في صورة بخار ماء نتيجة اكتسابه طاقة حرارية بالتسخين

## 3)Freezing of Water

Water freezes in polar regions to become ice. Due to the loss of heat energy.

تجمد الماء يتجمد الماء في المناطق القطبية ليصبح جليدا. نتيجة فقدانه طاقة حرارية

## 4)Melting of Ice

Ice melts in open spaces to become water.

Due to the gain of heat energy from the surrounding medium.

ينصهر الثلج في الأماكن المفتوحة ليصبح ماءا. نتيجة اكتسابه طاقة حرارية من الوسط المحيط انصهار الثلج

Complete 1)

1)The loss of heat energy by water vapor molecules in the air (cause) leads to its condensation into fog, dew, or clouds (result).

فقدان جزيئات بخار الماء في الهواء الجوي للطاقة الحرارية (السبب) يؤدى إلى تكثفه في صورة ضباب أو ندى أو سحب (النتيجة)

2)Melting and evaporation need heating

3)Freezing and condensation need cooling

## ** It is clear from the above that:

1) Transformations of matter from one state to another are reversible processes

2) Water turns into ice upon cooling, and vice versa, ice turns into water by heating.

1) تحولات المادة من الحالة الأخرى هي عمليات انعكاسية: الماء يتحول إلى ثلج بالتبريد، وبالعكس يتحول الثلج

3) Melting and freezing are reversible processes

أن الانصهار والتجمد عمليتان انعكاسيتان

4) Water vapor turns into water by condensation, and conversely, water turns into water vapor by evaporation.

بخار الماء يتحول ! إلى ماء بالتكثف، وبالعكس يتحول الماء إلى بخار ماء بالتبخر.

5) Evaporation and condensation are reversible processes

## **Important Note ملاحظة هامة:-

1) Water transformations from one state to another are considered physical changes

تحولات الماء من حالة لأخرى تعتبر تغيرات فيزيائية

2) It is not accompanied by a change in the composition of its molecules or the formation of new materials.

لا يصحبها تغير في تركيب جزيئاتها أو تكون مواد جديدة



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3) When water molecules ($H_2O$) evaporate due to the acquisition of heat, they do not turn into hydrogen and oxygen molecules.

جزيئات الماء $H_2O$ عند تبخرها باكتساب الحرارة لا تتحول إلى جزيئات هيدروجين وأكسجين

4) Whereas in chemical changes, a change in the composition of matter where a new substance is produced.

.. بينما في التغيرات الكيميائية يحدث تغير في التركيب الكيميائي حيث تنتج مادة جديدة

Other reversible processes in the transformation of matter include:

1) Sublimation 2) Precipitation

تشمل العمليات الانعكاسية الأخرى في تحويل المادة ما يلي:

1) التسامي 2) الترسيب

## 1)Sublimation التسامي

Sublimation The process of changing a substance from the solid state to the gaseous state directly without passing through the liquid state.

التسامي عملية تحول المادة من الحالة الصلبة إلى الحالة الغازية مباشرة دون المرور بالحالة السائلة

**Examples :-**

1) Solid iodine sublimes into iodine vapor on heating without passing through the liquid state.

تسامى اليود الصلب إلى بخار يود بالتسخين دون المرور بالحالة السائلة.

2) Dry ice sublimates when it gains heat energy and the surrounding environment

تسامى الثلج الجاف عند اكتساب طاقة حرارية من وسط المحيط

Dry ice is carbon dioxide in solid state.

Sublimation process

## 2) Precipitation الترسيب

Precipitation The process of changing a substance from the gaseous state to the solid state directly without passing through the liquid state.

التساقط او الترسب عملية تحول المادة من الحالة الغازية إلى الحالة الصلبة مباشرة دون المرور بالحالة السائلة

**Examples :-**

1) Iodine vapors precipitate upon cooling, forming solid iodine without passing through the liquid state.

تساقط أبخرة اليود بالتبريد مكونة اليود الصلب دون المرور بالحالة السائلة.

2) Formation of frost on the surfaces of crops and cars when the temperature of water vapor in the air drops below 0°C.

تكون الصقيع على أسطح المزروعات والسيارات عند انخفاض درجة حرارة بخار الماء الموجود في الهواء إلى أقل من صفر درجة مئوية

Formation of frost



Mr : Alifaz.N.Tadrous
01005136959- 01222978682

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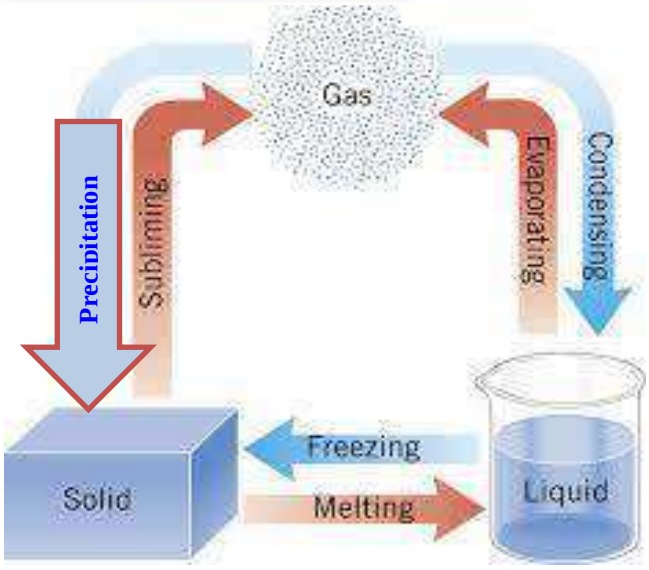


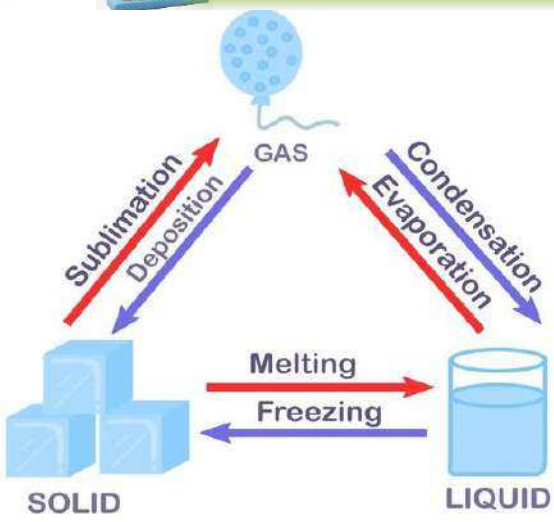

# Evaporation and Boiling

## How to Dry Wet Clothes Exposed to the Sun Even if the temperature does not reach 100

كيف تجف الملابس المبلّلة المعرضة لأشعة الشمس بالرغم من عدم وصول درجة الحرارة الى 100درجة سيلزية

| Boiling Process | Evaporation Process |
|---|---|
| | |
| 1-The process of **changing the mater from the liquid state to the gaseous state** at a specific point, which is the boiling point<br>(1) عملية تحول المادة من الحالة السائلة إلى الحالة الغازية عند نقطة محددة وهى درجة الغليان | 1-The process of **changing the mater from the liquid state to the gaseous state** at any temperature below the boiling point<br>(1) عملية تحول المادة من الحالة السائلة إلى الحالة الغازية عند أى درجة حرارة أقل من درجة الغليان. |
| 2-It occurs to all molecules of the liquid<br>3- It is carried out by thermal energy derived from a heat source<br>4-It **takes a short period of time**<br>5-It is accompanied by the formation of air bubbles (gas inside the liquid) | 2-Occurs to the molecules on the surface of the liquid<br>3-Carried out by thermal energy derived from the surrounding medium or a heat source<br>4-**Takes a long period of time**<br>5- Is not accompanied by the formation of air bubbles (gas inside the liquid |
| (2) تحدث لكل جزيئات السائل<br>(3) تتم بواسطة الطاقة الحرارية المستمدة من مصدر حرارى<br>(4) تستغرق فترة زمنية قصيرة نسبياً.<br>(5) يصاحبها تكون فقاعات هوائية ( غازية داخل السائل ). | (2) تحدث للجزيئات الموجودة على سطح السائل .<br>(3) تتم بواسطة الطاقة الحرارية المستمدة من الوسط المحيط أو مصدر حراري<br>(4) تستغرق فترة زمنية طويلة نسبيا .<br>(5) لا يصاحبها تكون فقاعات هوائية ( غازية داخل السائل ) . |



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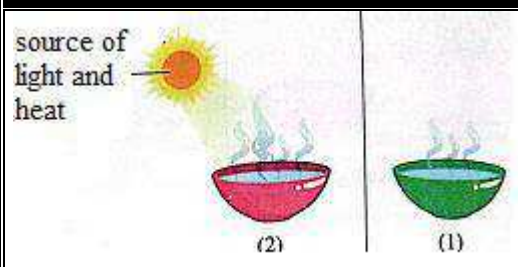
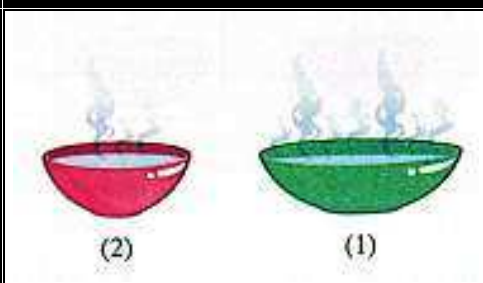
# Factors which affect the rate of evaporation of liquids,

1-Temperature 2-The surface area of the liquid exposed to the action 3- Humidity 4- Air currents

| **1-Temperature** | **2-The surface area** of the liquid exposed to the action |
|---|---|
|  |  |
| Control variable متغير ضابط | |
| .Liquid surface area<br>.Humidity<br>Air currents<br>. مساحة سطح السائل- نسبة الرطوبة- التيارات الهوائية. | .Temperature<br>.Humidity<br>Air currents<br>درجة الحرارة. -نسبة الرطوبة -التيارات الهوائية |
| Independent variable متغير مستقل | |
| Temperature difference<br>اختلاف درجة الحرارة | Liquid surface area<br>مساحة سطح السائل |
| Dependent variable متغير تابع | |
| The evaporation rate in pot (2) is greater than in pot (1)<br>معدل التبخر في الإناء (2) أكبر مما في الإناء (1) | The evaporation rate in pot (1) is greater than in pot (2)<br>معدل التبخر في الإناء (1) أكبر مما في الإناء (2) |
| Conclusion الاستنتاج | |
| The evaporation rate increases when the temperature rises<br>زيادة معدل التبخر عند ارتفاع درجة الحرارة | The evaporation rate increases when the surface area of the liquid subject to evaporation increases<br>زيادة معدل التبخر عند زيادة مساحة سطح السائل المعرض للتبخر |
| Explanation الشرح | |
| The rate of evaporation increases due to the increase in the number of molecules that have enough heat energy from the surrounding medium<br>يزداد معدل التبخر الزيادة عدد الجزيئات التي تمتلك القدر الكافى من الطاقة الحرارية اللازمة من الوسط المحيط للتحرر من سطح السائل | The rate of evaporation increases as the number of molecules that can gain the necessary thermal energy from the surroundings to escape from the surface .of the liquid increases<br>يزداد معدل التبخر الزيادة عدد الجزيئات التي يمكنها اكتساب الطاقة الحرارية اللازمة من الوسط المحيط للتحرر من سطح السائل |

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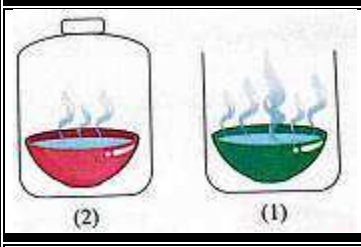
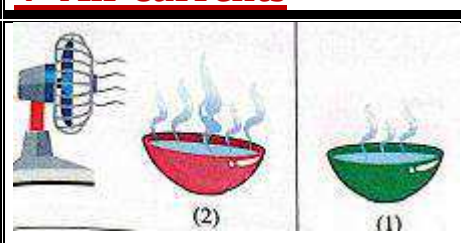
| 3- Humidity | 4- Air currents |
|---|---|
|   |   |
| Control variable متغير ضابط | |
| Liquid surface area<br>Temperature - Air currents<br>مساحة سطح السائل- درجة الحرارة- التيارات الهوائية . | Liquid surface area<br>Temperature - Humidity<br>مساحة سطح السائل- درجة الحرارة- الرطوبة . |
| Independent variable متغير مستقل | |
| Difference in humidity<br>Percentage of water vapor present in the air<br>اختلاف نسبة الرطوبة<br>(نسبة بخار الماء الموجود في الهواء الجوى ) | Air currents<br>التيارات الهوائية- |
| Dependent variable متغير تابع | |
| The evaporation rate in vessel (1) is greater than in vessel (2)<br>معدل التبخر في الإناء (1) أكبر مما في الإناء (2) | The evaporation rate in vessel (2) is greater than in vessel (1)<br>معدل التبخر في الإناء (2) أكبر مما في الإناء (1) |
| Conclusion الاستنتاج | |
| The evaporation rate increases when the humidity decreases<br>زيادة معدل التبخر عند نقص نسبة الرطوبة | The evaporation rate increases when the speed of air currents increases<br>زيادة معدل التبخر عند زيادة سرعة التيارات الهوائية |
| Explanation الشرح | |
| The retention of water vapor in the air of vessel (2) reduces the evaporation rate, while the escaping water vapor from the uncovered vessel (1) increases the chances of more surface molecules evaporating.<br>احتباس بخار الماء فى هواء الوعاء (2) يقلل من معدل التبخر، بينما تصاعد بخار الماء من الوعاء (1) غير المغطى يزيد من فرص تبخر المزيد من جزيئات السطح | Air currents increase the evaporation of more water molecules from the surface of the liquid<br>تزيد التيارات الهوائية من تبخر المزيد من جزيئات ماء سطح السائل |

The evaporation rate increases

| with an increase | with a decrease |
|---|---|
| liquid surface area –temperature- speed of air currents | humidity |

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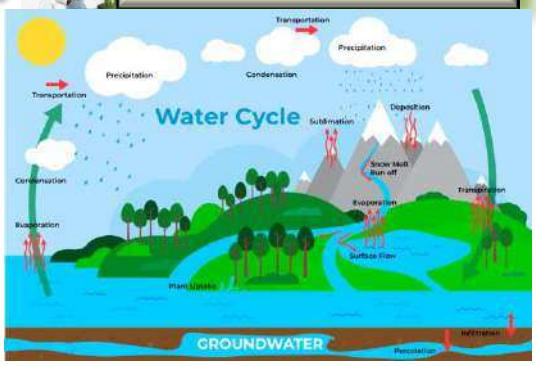
# Integration with Hydrology
**التكامل مع علم المياه (الهيدرولوجيا)**




The water cycle in nature is based on the transformation of water from one state to another, through the processes of
Evaporation –Condensation- Melting- Freezing
**دورة الماء فى الطبيعة تقوم على تحولات الماء من حالة إلى أخرى، عبر عمليات**
**التبخر –التكثف– الانصهار- التجمد**

The water cycle in nature directly affects many weather factors
تؤثر دورة الماء فى الطبيعة بصورة مباشرة على الكثير من عوامل الطقس.

## Technological Application: Instant Coffee
تطبيق تكنولوجى القهوة الفورية ( سريعة الذوبان)

Regular coffee is prepared from ground coffee beans and it does not dissolve in water, while instant coffee dissolves quickly in water
القهوة العادية تحضر من حبوب البن المطحونة و هى لا تذوب فى الماء، بينما القهوة الفورية سريعة الذوبان فى الماء.

## Steps for Making Instant Coffee
خطوات صناعة القهوة الفورية

1-A concentrated syrup is prepared from regular coffee
يحضر شراب مركز من القهوة العادية.

Regular coffee and instant coffee

2-The spray of the syrup is exposed to very hot, dry air about 250ºC G.R.?
... (250 على يُعرض رذاذ الشراب لهواء جاف شديد الحرارة حوالى

Increasing the surface area of the spray balls exposed to the hot air and thus increasing the evaporation rate.
الزيادة مساحة أسطح كرات الرذاذ المعرضة للهواء الساخن وبالتالي زيادة معدل التبخر.

3-Collecting solid instant coffee crystals
تجمع بللورات القهوة الفورية الصلبة.

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## Unit One, Lesson (2)

### 1- Write Scientific term

(1) The temperature at which a substance changes from the solid to the liquid state. (…….)

(2) The point at which the temperature of a substance is constant during its change from the solid to the liquid state. (…….)

(3) The temperature at which a substance changes from the liquid to the gaseous state at a specific point (…….)

(4) The temperature at which all the particles of a liquid overcome the forces of attraction between them and turn into particles of a gas. (……..)

(5) Atmospheric air pressure at sea level. (……..)

(6) The process of a substance changing from the solid state directly to the gaseous state without passing through the liquid state. (……..)

(7) The process of a substance changing from the gaseous state to the solid state directly without passing through the liquid state.

(8) Solid carbon dioxide. (……..)

### 2)Complete the following sentences with the appropriate word:

(1) At normal atmospheric pressure, the melting point of ice is..... °C While the boiling point of water is……..°C

(2) The temperature at which ice begins to change into water is called..... While the temperature at which water begins to change into water vapor In all its parts is called...

(3) At the melting point,……..... weakens between the particles of a substance, so……. Increases between them.

(4) Among the factors affecting the melting and boiling points of substances are.....and ……

(5) When atmospheric pressure decreases, the boiling point of liquids……. and their freezing point……

(6) When 342 g of glucose is dissolved in 1L of water, the boiling and freezing points of the solution become..... , ……respectively.

(7) At the melting point, the substance is in both states……. , ……. At the same temperature

(8) The loss of thermal energy accompanies to…… and…… processes during the transformations of matter.

(9) The gain of thermal energy accompanies to …… and…… processes during the transformations of matter.

(10) The process of evaporation is the opposite of the process of …..... while the process of sublimation is the opposite of the..... process.

(11) The loss of thermal energy by water vapor molecules in the air leads to its condensation in the form of …….. or fog or ……...



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(12) The process of ……. occurs only on the surface of the liquid, while ..... occurs in all parts of the liquid.

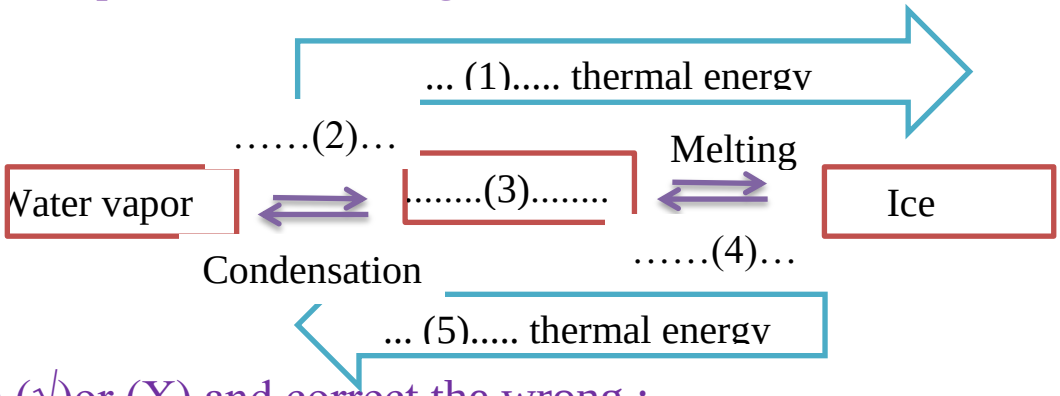
(13) At the boiling point the molecules of ……matter overcome The forces of ..... between the molecules.

14)Evaporation process takes ……period of time , while boiling process takes ……period of time

15) The rate of evaporation increase by increasing……. And decreasing …….. During the transformations of matter.

(16) Regular coffee ……in water, while instant coffee …….. dissolves in water.

## 3)Complete the following chart:




## 4) (√)or (X) and correct the wrong :

(1) Pure water boils at 0°C at normal atmospheric pressure. ( )

(2) When water boils, the forces of attraction between the particles increase and the physical distances between them decrease. ( )

(3) The state of a substance changes from one state to another by gaining heat energy. ( )

(4) During the processes of melting and boiling, the temperature remains constant. ( )

(5) The melting point of wax is equal to the melting point of table salt. ( )

(6) The temperature decreases by about 1°C for every 10m we go up. ( )

(7) Cooking time in a saucepan is less than cooking in a normal saucepan. ( )

(8) Every pure substance has a characteristic boiling point. ( )

(9) The amount of depression in the freezing point of solutions depends on their concentrations. ( )

(10) Water freezes in polar regions as a result of gaining thermal energy. ( )

(11) Dry ice is nitrogen in the solid state. ( )

(12) The rate of evaporation increases when the speed of air currents above the surface of the liquid increases. ( )

(13) An increase in the humidity percentage leads to an increase in the rate of evaporation( )

(14) The water cycle in nature directly affects many weather factors. ( )



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## 5) Choose the correct answer from the given answers:

(1) The speed of the particles that make up the substance increases when the processes of.

a)condensation and evaporation b) condensation and freezing.

c )evaporation and melting. D) freezing. and melting

(2) When a certain volume of water boils, a larger volume of steam is produced, because.

a)steam molecules are farther apart than water molecules

b)The composition of water is different from the composition of water vapor.

c)The conversion of water to vapor increases the number of molecules.

d)Water molecules collide when heated.

(3) What happens to the particles of a solid when they melt?

a)They continue to vibrate around their position.

b)They move freely and randomly in all directions.

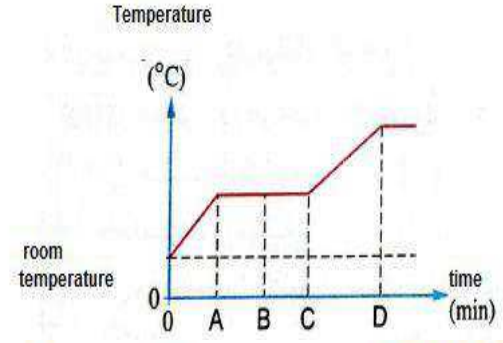
c)They stop vibrating.

d)They are freed from their fixed positions.

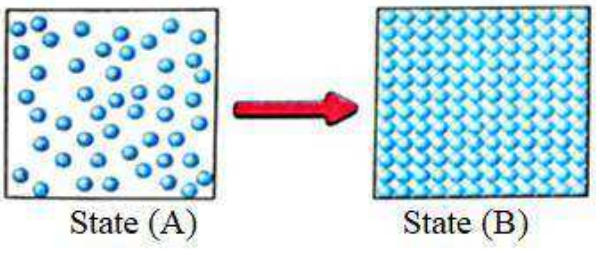
(4) The opposite graph represents the heating of a solid. What is the time at which the substance completely changes to the liquid state?

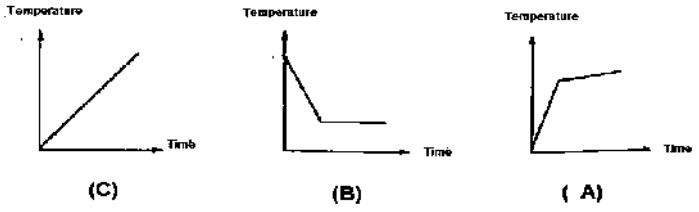
(A)A (B) B

(C)C (D) D

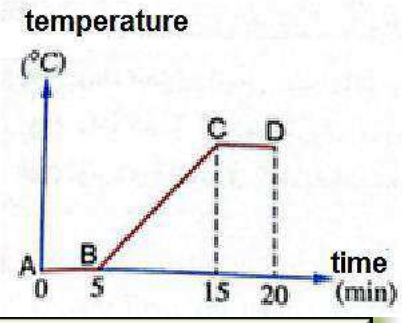



(5) A substance (X) changes from state (A) to state (B) as shown in the opposite figure. Which of the following graphs represents the temperature of a substance (X) over time?




6)The opposite graph represent change in the temperature in a flask contain pieces of ice through 20 minutes , which of the following is correct?




| Choices | Periods In which the substance gains heat | Periods in which a change in the state of matter occurred |
|---|---|---|
| A | BC | BC. AB |
| B | BC , AB | CD. BC |
| C | CD. BC. AB | CD . AB |
| D | CD. BC. AB | CD. BC. AB |



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(7) A solid substance with a melting point of 1500 °C turns into a liquid state at...

A)1000°C B)1500°C C)1550 °C d)2000°C

(8) The boiling point of water at the top of a mountain 3000 meters high is equal to.

A) 100°C B) 94°C C)90°C D)84°C

9) When sodium chloride dissolves in water.

a) The melting point of the solution increases.

b) The boiling point of the solution increases.

c) The boiling point of the solution decreases.

d) The melting point of the solution does not change.

(10) All of the following represent water transformations, except:

a) Reflexive operations. b) Physical processes.

C) Chemical processes. d)Accompanied by a thermal change.

(11) Each of the following processes requires the acquisition of thermal energy to occur, except for...

a)Boiling. B) Melting C) evaporation. d) Freezing .

12) Melting point is opposite to …….process

a) precipitation b)Condensation c)Freezing d) Sublimation.

13) In the following activity

……Energy is required for the process (X) to occur.

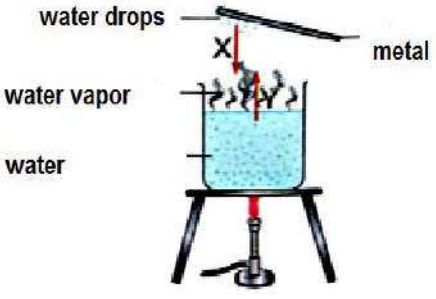
While for the process (Y) to occur,….. energy is required.

a) Gain/Lost.

b) acquire/acquire

C) lost/gained.

d) Lost/lost.




(14) From the opposite figure: Which of the following represents (X), (7)?

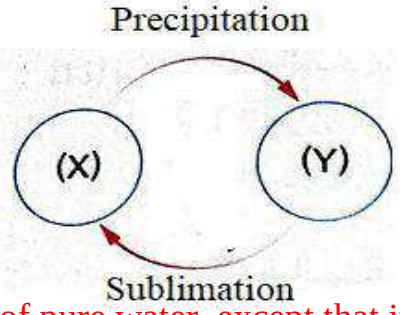
A) (X) Solid, (Y) liquid B) (X) liquid, (Y) Solid

C) (X): Solid, (Y): Gas D) (X) Gas , (Y) Solid

(15) The formation of frost represents the process of……

A) Evaporation B) Sublimation

C) Precipitation. D) Condensation.




(16) Each of the following represents the process of evaporation of pure water, except that it

a) occurs at 40 °C b)occurs only for surface molecules.

c) occurs without heating. d) accompanied by the formation of gas bubbles

(17) Wet clothes dry when exposed to the sun as a result of a process.

A) Melting B) Evaporation C) boiling D)Condensation.

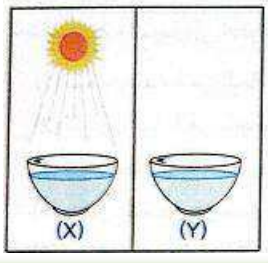
(18) In the opposite figure: The rate of evaporaton in.

A) Each of the two vessels (X) and (Y) is very fast.

B) Each of the two vessels (X) and (7) is very slow.

C) Vessel (Y) is larger than vessel (X).

d) Vessel (Y) is slower than vessel (X).



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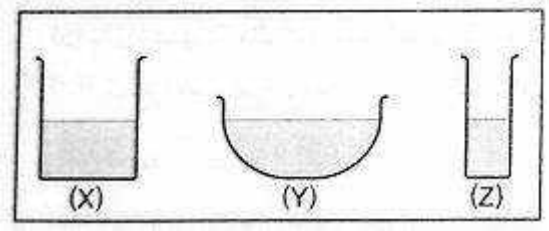
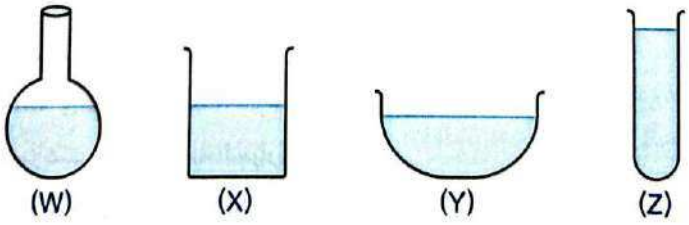
(19) From the opposite figure:
Which of the following expresses the rate of evaporation of water in the three vessels when exposed to the same temperature?




A) (Z) > (Y) > (X) B)(x) > (Y) > (Z)
C)(Y) > (X) > (Z) D)(X) > (Z) > (Y)

(20) The following figures represent four vessels containing equal amounts of water left in the atmosphere for two days:




Which container contains the largest amount of water after two days?
A) (W) B) (X) C) (Z) D) (Y)

(21) The rate of evaporation increases with an increase in each of the following, except for .....
A) Temperature B)Surface area of the liquid exposed to evaporation.
C)Humidity. D)Air currents.

## Essay Questions

### 6)What is meant by:-

1) Melting

(2) Boiling point.

(3) Sublimation.

(4) Precipitation.

(5) Dry ice.

(6) Hydrology.

### 7)Explain the following (give reasons:-:

(1) A substance changes from the solid state to the liquid state upon heating.
.....

(2) A substance changes from the liquid state to the gaseous state upon heating.
.....

(3) During the processes of melting, evaporation, and boiling, the temperature remains constant, despite continued heating
.....



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(4) The purity of substances can be verified by measuring their melting or boiling points at constant values when they are in the pure state.

(5) The boiling point of pure water is lower than 1000 on mountaintops.

(6) Cooking in a saucepan consumes less fuel.

(7) The boiling point of a glucose solution is higher than that of distilled water.

(8) Water droplets form on the outer surface of a cup of iced water.

(9) Ice turns into water when left in an open area.

(10) Water freezes in polar regions.

(11) Transformations of matter from one state to another are reversible processes.

(12) Evaporation takes longer than boiling.

(13) Wet clothes dry faster in summer than in winter.

(14) The rate of evaporation increases when the temperature rises.

(15) The rate of evaporation increases when the surface area of a liquid exposed to evaporation increases

(16) The evaporation rate increases when the speed of air currents increases.

(17) Feeling unwell in hot, humid weather.

## 8)What happens when:

(1) A solid substance gains thermal energy.

(2) A liquid substance gains thermal energy.

(3) Ice continues to gain more thermal energy during the melting process.

(4) The atmospheric pressure affecting pure water is lower than the usual atmospheric pressure.



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(5) The temperature of water vapor in the air decreases to less than 0

.....

(6) A piece of ice is left in the air for a period of time.

.....

(7) Dry ice is left in an open place.

.....

(8) Solid iodine is heated.

.....

(9) A spray of a concentrated syrup of regular coffee is exposed to very hot, dry air.

.....

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# lesson (3) Internal energy and temperature

## Concept of System

مفهوم النظام

Every system has a boundary that separates it from its surroundings.

كل نظام له حدود تفصله (تميزه) عن الوسط المحيط به.

### System

النظام

Any part of the universe that is the subject of study and observation of changes in energy and matter

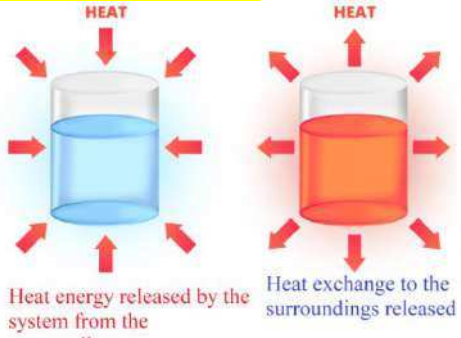
أي جزء من الكون ، يكون موضعا الدراسة وملاحظة تغير الطاقة والمادة به.

### Surrounding

الوسط المحيط

The space surrounding the system with which it can exchange energy, matter, or both

المساحة المحيطة بالنظام والتي يمكنه من خلالها تبادل الطاقة أو المادة أو كليهما



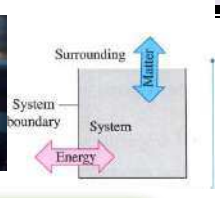

Heat energy released by the system from the

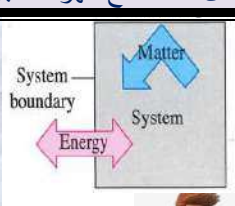
Heat exchange to the surroundings released

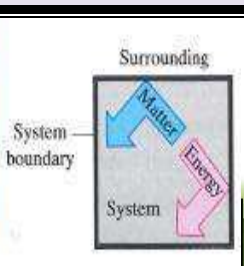
## Types of Systems

Heat exchange between the system and the surroundings

| Open System | Closed System | Isolated System |
|---|---|---|
| The system that allows the exchange of both matter and energy between the system and the surrounding medium. | the system that allows energy exchange only between the system and the surrounding medium. | It does not allow any transfer of energy or matter between the system and the surrounding medium. |
| النظام المفتوح نظام يحدث فيه تبادل للطاقة والمادة مع الوسط المحيط | نظام يحدث فيه تبادل للطاقة فقط دون المادة مع الوسط المحيط | نظام لا يحدث فيه تبادل للطاقة أو المادة مع الوسط المحيط |
| An open pot containing boiling water( open system) G.R<br>Because heat and water vapor are exchanged with the air<br>لأنه يحدث فيه تبادل الحرارة وبخار الماء مع الهواء الجوي | A can of soft drink (closed system) G.R<br>Because only heat is exchanged, without the exchange of matter with the air<br>لأنه يحدث فيها تبادل الحرارة فقط دون تبادل المادة مع الهواء الجوي | A thermos ( isolated system) G.R<br>Because no heat or matter is exchanged with the surroundings<br>لأنه لا يحدث فيه تبادل الحرارة أو المادة مع الوسط المحيط |







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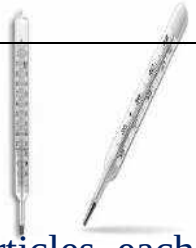
The following figures represent three different systems. State the type of system each figure represents, with explanation

| Figure | Type of System | Explanation |
|---|---|---|
| (A) | Closed | Because only energy is exchanged with the surroundings in the form of heat |
| (B) | Isolated | Because neither matter nor energy is exchanged with the surroundings |
| (C) | Open | Because both matter and energy are exchanged with the surroundings |

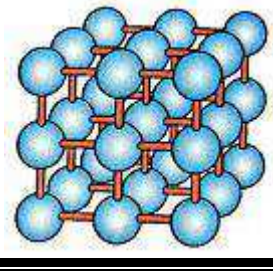
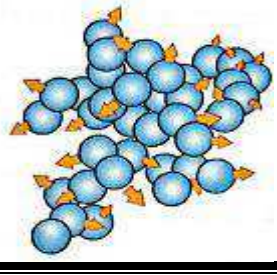
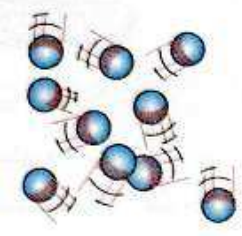
**.G.R.:** A medical thermometer is considered a closed system ?

Because only energy is exchanged with the surroundings in the form of heat



## The internal energy of the system

Any system - in light of the particle theory of matter - consists of particles, each of which has potential energy and kinetic energy, differ according to state of matter

| | Solid | Liquid | Gaseous |
|---|---|---|---|
| Shape |  |  |  |
| Potential energy (P.E.) | As high as possible. Why? Because the attraction force between its particles are very strong and the intermolecular space between them are very small | Medium.. Why? Because the attraction force between its particles are medium and intermolecular space between them are medium | Almost zero... Why? Because the attraction force between its particles are very weak and the intermolecular space between them are very large |
| Kinetic energy (K.E.) | Small... Why? Because its particles only vibrate around their positions | Medium... Why? Because its particles move relatively freely in .their container | Very high Why? Because its particles move completely freely |



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The sum of the potential and kinetic energy of any given system is known as the .internal energy of the system

.يُعرف مجموع طاقة الوضع وطاقة الحركة لأى احة الداخلية للنظام

**The internal energy of the system =** the potential energy **+** the kinetic energy

الطاقة الداخلية للنظام =طاقة الوضع + طاقة الحركة

The internal energy of a system increases with an increase in the potential energy of the particles, the kinetic energy, or both

.تزداد الطاقة الداخلية للنظام بزيادة طاقة وضع الجسيمات أو طاقة حركتها أو بزيادتهما معا

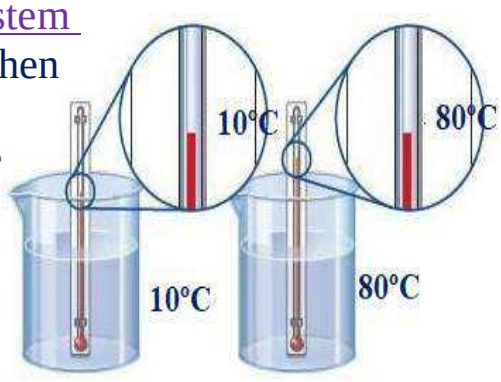
## The internal energy of a system depends on

1- Its temperature
2- Its mass (number of particles)
3- Its matter type
4- Its physical state

## 1-Temperature

The average kinetic energy of the particles of a system is equal to the kinetic energy of a single particle when .the kinetic energy of all particles is equal

متوسط طاقة الحركة لجسيمات نظام يساوى طاقة الحركة الجسيم واحد عند تساوى طاقة الحركة لجميع الجسيمات.




Temperature represents the degree of hotness or coldness of any system .

تمثل درجة الحرارة درجة سخونة أو برودة أي نظام.

Temperature of the system

The average kinetic energy of the particles of the system

$$\text{Average kinetic energy Particles of the system} = \frac{\text{Total kinetic energy of the particles}}{\text{Number of particles}}$$

**If we assume that** The kinetic energy of all particles is equal Then

وإذا افترضنا أن طاقة الحركة لجميع الجسيمات متساوية فإن...

The temperature of the substance or system is a measure of the kinetic energy of one particle

درجة حرارة المادة أو النظام تكون مقياس الطاقة الحركة لأحد الجسيمات.

**G.R.:** Why is temperature considered a measure of the average kinetic energy of particles and not the kinetic energy of particles

Because the kinetic energy different from one particle to another in the same substance

لماذا تعد درجة الحرارة مقياس لمتوسط طاقة حركة الجسيمات وليس طاقة حركة الجسيمات

لأنه طاقة الحركة تختلف من جسيم إلى آخر في نفس المادة



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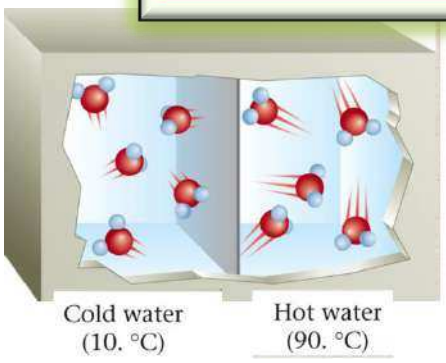
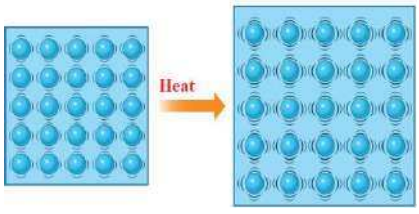
## The effect of heating on potential and kinetic energies




The average kinetic energy of hot water particles is greater than the average kinetic energy of cold water particles.
متوسط طاقة حركة جسيمات الماء الساخن أكبر من متوسط طاقة حركة جسيمات الماء البارد.

**When a substance (system) gains an amount of thermal energy,**(What happen when) the average kinetic energy of its particles increases, leading to an increase in the temperature of the system and vice versa
عند اكتساب المادة (النظام) كمية من الطاقة الحرارية يزداد متوسط طاقة حركة جسيماتها، مما يؤدى إلى ارتفاع درجة حرارة النظام والعكس صحيح.

The internal energy of water particles increases when it gains thermal energy.
تزداد الطاقة الداخلية لجسيمات الماء عند اكتسابه طاقة حرارية

**G.R.:** The speed of diffusion of odors in hot air is greater than their speed of diffusion in cold air.
علل ؟ سرعة انتشار الروائح في الهواء الساخن أكبر من سرعة انتشارها في الهواء البارد.

Because the kinetic energy of hot air is greater than cold air
لأن الطاقة الحركية للهواء الساخن أكبر من الطاقة الحركية للهواء البارد

The average kinetic energy of water particles is greatest at a temperature (100ºC)

## Evaluation

(1)Choose the correct answer from the given answers

1-A tightly sealed thermos represents system (X), while a hot cup of tea represents system(Y)
Which of the following represents each of the two systems

a. (X): closed, (Y): open  b. (X): closed, (Y) Isolated
c. (X): Isolated, (Y): open  d. (X): Isolated (Y) closed

2-The internal energy of the system

a. Potential energy + Kinetic energy  b. $\frac{\text{Total kinetic energy of the particles}}{\text{Number of particles}}$
c. Potential energy × Kinetic energy  d. Kinetic energy × **Number of particles**

3-Increasing the speed of the particles of a substance leads to an increase in all of the following, except

a. Kinetic energy  b. Internal energy of the substance
c. Temperature of the substance  d. Potential energy

4-When ($cm^3$) of water in a test tube is heated to boiling point, 1600 $cm^3$ of water vapor is formed This is because

a. The size of the water vapor molecules is larger
b. The water molecules do not move before boiling
c. The water vapor molecules increase when boiling
d. The distances between the water vapor molecules are larger



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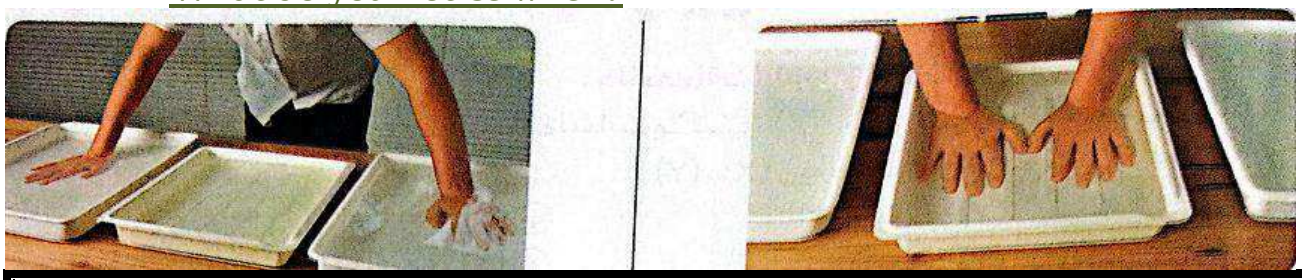
# Factors affecting the amount change of temperature
العوامل المؤثرة في مقدار تغير درجة حرارة

## What do you notice when? ماذا تلاحظ عند ؟



| | |
|---|---|
| Place one hand in hot water and the other hand in ice water<br>وضع أحد اليدين في ماء ساخن واليد الأخرى في ماء | Then put your hands in warm water<br>وضع اليدين بعد ذلك في ماء فاتر. |
| One hand feels hot and the other hand feels cold<br>تشعر أحد اليدين بالسخونة واليد الأخرى بالبرودة | A hand that was placed in hot water feels cool. and that was placed in cold water feels hot<br>تشعر اليد التي كانت موضوعة في الماء الساخن بالبرودة. والتي كانت موضوعة في الماء البارد بالسخونة |

It is clear from the above that يتضح مما سبق أن

The transfer of heat from or to a body or system is indicated by a change in its temperature.

انتقال الحرارة من أو إلى جسم أو نظام يستدل عليه من تغيرة رجة حرارته

A body gains thermal energy by raising its temperature, while a body loses thermal energy by lowering its temperature.

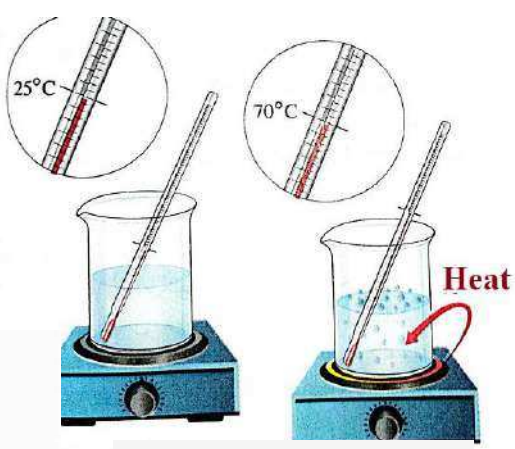
فاكتساب الجسم الطاقة حرارية برفع درجة حرارته، بينما فقدان الجسم الطاقة حرارية يخفض درجة حرارته ،

## The amount of change in the temperature of any body or system depends on

ويتوقف مقدار التغير في درجة حرارة أى جسم أو نظام على عدة عوامل منها

1-mass of matter
2-Type of material
3-State of matter

1 كتلة المادة
2 نوع المادة
3 حالة المادة



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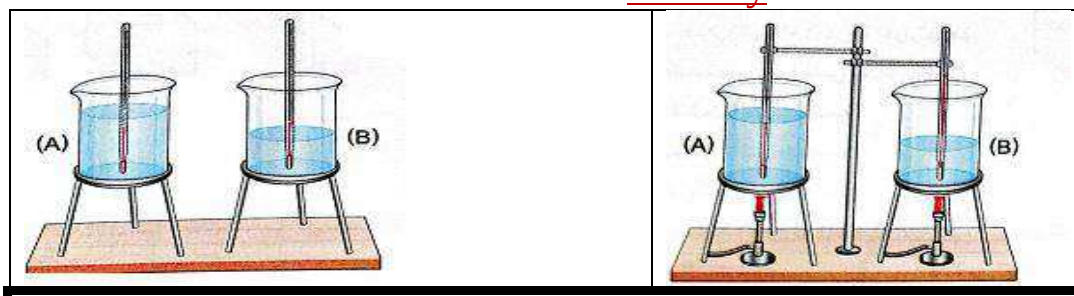
# 1-The effect of the **mass of a matter** on the change in its temperature

أثر كتلة المادة على تغير درجة حرارتها

## Activity




| | |
|---|---|
| 1-Place 1 kg of water in beaker (A ) and ½ kg in beaker (B)<br>2-Record the temperature of the water in each beaker using a thermometer... | 3-Heat each of the beakers over a regular flame... Explain? So that the heating time becomes a measure of the amount of heat gained by the water<br>4-Record the temperature of the water in each beaker at equal intervals |
| **Observation** temperature of the water in beaker (A) = the temperature of the water beaker (B) despite their different masses<br>درجة حرارة ماء الكأس (A) = درجة حرارة ماء الكأس (B) رغم اختلاف كتلتيهما | **Observation** The temperature of the water in beaker (B) is higher than its in beaker (A)<br>ارتفاع درجة حرارة الماء في الكأس (B) عن ارتفاعها في الكأس (A).. |
| **Conclusion** The amount of change in temperature of different masses of the same substance differs when they gain lose the same amount of thermal energ<br>يختلف مقدار التغير في درجة حرارة الكتل المختلفة من نفس المادة عند اكتسابها أو فقدها نفس الكمية من الطاقة الحرارية. | The control variable: the heating time (amount of heat gained) the type of substance<br>المتغير الضابط : زمن التسخين (كمية الحرارة المكتسبة)، نوع المادة.<br>The independent variable: the mass of the water in the two beakers<br>المتغير المستقل : كتلة الماء في الكأسين<br>The dependent variable: the amount of change in temperature<br>المتغير التابع : مقدار التغير في درجة الحرارة. |

## Explanation

| | |
|---|---|
| The temperature increases by a greater amount when the mass decreases... Why<br>Because the thermal energy gained by the substance is distributed over a smaller number of particles, its average kinetic energy increases by a greater amount<br>تزداد درجة الحرارة بمقدار أكبر عند نقص الكتلة ... لماذا ؟<br>لأن الطاقة الحرارية التي تكتسبها المادة تتوزع على عدد أقل من الجسيمات فيزداد متوسط طاقة حركتها بمقدار أكبر. | The amount of temperature increase for a single substance decreases with an increase in its mass... Why<br>Because the thermal energy gained by the substance is distributed over a larger number of particles, its average kinetic .energy increases by a smaller amount<br>مقدار الارتفاع في درجة حرارة المادة الواحدة يقل بزيادة كتلتها ... لماذا ؟<br>لأن الطاقة الحرارية التي تكتسبها المادة تتوزع على عدد أكبر من الجسيمات فيزداد متوسط طاقة حركتها بمقدار أقل. |



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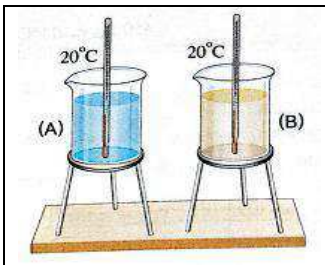
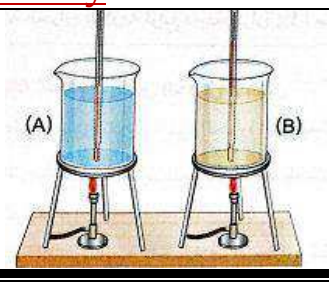
## 2-The effect of Type of material of a substance on the change in its temperatur

أثر نوع المادة على تغير درجة حرارتها

### Activity




1-Place 1 kg of water in beaker (A ) and 1 kg of oil in beaker (B)
2-Record the temperature of the water and oil in each beaker using a thermometer...

3-Heat each of the beakers over a regular flame until the heating time becomes a measure of the amount of heat gained by the water
4-Record the temperature of the water in each beaker at equal intervals

**Observation** The temperature of the wat in beaker (A) - the temperature of the oil i beaker (B) despite their being of different types

درجة حرارة ماء الكأس (A) = درجة حرارة ويت الكأس (B) رغم اختلاف نوعيهما

**Observation** The temperature of the oil in beaker (B) is higher than the temperature of the water in beaker (A)

درجة حرارة الزيت في الكأس (B) اعلى عن درجتها في الكأس (A)..

The amount of change in the temperature of equal masses of different materials differs when they gain or lose the same amount of thermal energy

**Explanation**

When two equal masses of oil and water are heated by the same heat source for the same period of time, the temperature rise in the oil is greater than that in the water...
Explain? Because the specific heat of the oil is less than the specific heat of the water

عند تسخين كتلتين متساويتان من الزيت والماء بنفس المصدر الحراري لنفس الفترة الزمنية يكون مقدار الارتفاع في درجة حرارة الزيت أكبر مما في الماء ... علل ؟ لأن الحرارة النوعية للزيت أقل من الحرارة النوعية للماء.

Both cups receive the same amount of heat

كلا الكأسين يستقبلا نفس كمية الحرارة

**Control variable** المتغير الضابط

The mass of oil and water

كتلة الزيت والماء

The amount of heat gained

كمية الحرارة المكتسبة

**Independent variable** المتغير المستقل

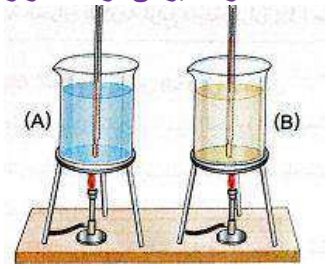
The type of material used

نوع المادة المستخدمة

**Dependent variable** المتغير التابع

The amount of change in temperature

مقدار التغير فى درجة الحرارة



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## Specific Heat

الحرارة النوعية .

The amount of heat required to raise the temperature of 1Kg of matter by 1°C

كمية الحرارة اللازمة لرفع درجة حرارة 1kg من المادة بمقدار 1°C

What Is the meant by that the specific heat of iron is 450°J

ما معنى قولنا أن ؟ الحرارة النوعية للحديد 450°J.

That is, the amount of heat required to raise the temperature of 1 kg of iron by 1°C is 450 J

أي أن كمية الحرارة اللازمة لرفع درجة حرارة 1kg من الحديد بمقدار 100 تساوى 450j

The opposite table the specific heat values of some substances

| Substance | Specific Heat (J/kg.°C) |
|---|---|
| Mercury | 140 |
| Copper | 385 |
| Iron | 450 |
| Aluminum | 900 |
| Corn Oil | 2000 |
| Ice | 2090 |
| water | 4180 |

Specific heat is a characteristic property of a substance and varies depending on

الحرارة النوعية خاصية مميزة للمادة وتختلف باختلاف كل من .

-The type of substance نوع المادة -

-The physical state, such as the difference between the specific heat of ice and liquid water

- الحالة الفيزيائية كاختلاف الحرارة النوعية للثلج عن الماء السائل

The amount of heat required to raise the temperature of 1 kg of water by 1°C is greater than that of any substance

كمية الحرارة اللازمة لرفع درجة حرارة 1kg من الماء بمقدار 10 أكبر مما لأى مادة أخرى. .

**take care**

1-When the specific heat of a matter is large عندما تكون الحرارة النوعية للمادة كبيرة

The amount of heat required to raise the temperature of a matter by 1°C is large (and vice versa)

تكون كمية الحرارة اللازمة لرفع درجة حرارة المادة بمقدار 1°C كبيرة ( والعكس صحيح). .

2-The amount of temperature increase in a material is small when it gains a certain amount of heat

يكون مقدار الارتفاع في درجة حرارة المادة صغير عند اكتسابها كمية معينة من الحرارة.

The material takes a long time to lose the energy it gained (i.e., it cools slowly) - (and vice versa

تستغرق المادة وقتا طويلا لفقد الطاقة التي اكتسبتها (أي تبرد ببطء) (والعكس صحيح)..

Application

When two equal masses of copper and aluminum gain the same amount of heat, the temperature rise in the copper is greater than the temperature rise in the aluminum... Explain؟

عند اكتساب كتلتان متساويتان من النحاس والألومنيوم نفس كمية الحرارة يكون مقدار الارتفاع في درجة حرارة النحاس أكبر من مقدار الارتفاع في درجة حرارة الألومنيوم ... علل ؟

Because the specific heat of copper is lower than that of aluminum, copper is thermally preferred over aluminum in the manufacture of heating utensils

لأن الحرارة النوعية للنحاس أقل مما للألومنيوم لذا يفضل حراريا النحاس عن الألومنيوم فى صناعة أوانى التسخين.



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## Give reason

1-Why is mercury used in the manufacture of thermometers

لماذا يستخدم الزئبق في صناعة الترمومترات

Because the specific heat of mercury is low, and therefore its temperature rises ( quickly when any amount of heat is gained

) لأن الحرارة النوعية للزنبق منخفضة وبالتالي ترتفع درجة حرارته سريعا عند اكتساب أي كمية حرارة.

2-Why does water constitute a large percentage of the human body

لماذا يدخل الماء بنسبة كبيرة في تركيب جسم الإنسان ؟

Because the specific heat of water is high, and therefore it maintains a constant body temperature when the temperature of the surrounding medium changes

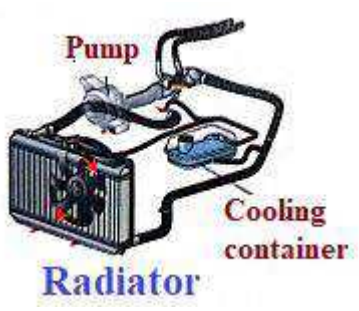
لأن الحرارة النوعية للماء مرتفعة وبالتالي يحافظ على ثبات درجة حرارة الجسم عند تغير درجة حرارة الوسط المحيط

3-Water is used in the cooling system connected to car engines known as the radiator... Explain

يستخدم الماء في نظام التبريد المتصل بمحركات السيارات والمعروف بالرديتاير ... علل ؟ .

To protect engines from damage due to high temperatures

لحماية المحركات من التلف بفعل الارتفاع في درجة الحرارة




4-Water is an excellent cooling fluid... Explain

الماء يعد سائلا ممتازا للتبريد ... علل ؟

Because its high specific heat, it absorbs large amounts of thermal energy without a significant increase in its temperature

الارتفاع حرارته النوعية، فهو يمتص كميات كبيرة من الطاقة الحرارية دون حدوث ارتفاع كبير في درجة حرارته.

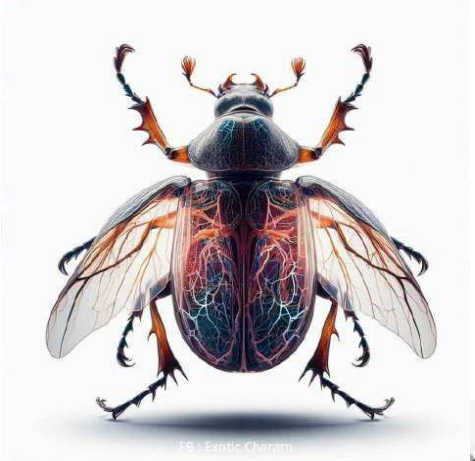
You have two quantities of water and oil with the same mass at a temperature of 200°C. They were heated by a heat source. Which of the two liquids takes longer to reach a temperature of 60°C? Explain.

لديك كميتان من الماء والزيت لهما نفس الكتلة عند درجة حرارة 200 ، تم تسخينهما بواسطة مصدر حراري أي السائلين يستغرق زمنا أكبر للوصول إلى درجة حرارة 60 ؟ مع التفسير

Water takes longer to raise its specific heat than the specific heat of oil

يستغرق الماء الزمن الأكبر لارتفاع حرارته النوعية عن الحرارة النوعية للزيت.

The material used in making ice boxes It must takes a long time to lose heat



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## 1-The effect of the type of a substance on the change in its temperature
أثر حالة المادة على تغير درجة حرارتها

### Practical Activity (3 Steps

1-Place 500 g of water 20ºC in one beaker
And 500 g of ice -5ºC in other beaker
2-Heat each beaker using a regular flame for two minutes
3-Record the thermometer readings for both the water and the ice and calculate the amount of the change in their temperatures.

### Observation

The amount of temperature increase in the ice (solid) is greater than the amount of temperature increase in the water (liquid )
مقدار الارتفاع في درجة حرارة الثلج (الصلب ) يكون أكبر من مقدار الارتفاع في درجة حرارة الماء (السائل).

### Conclusion

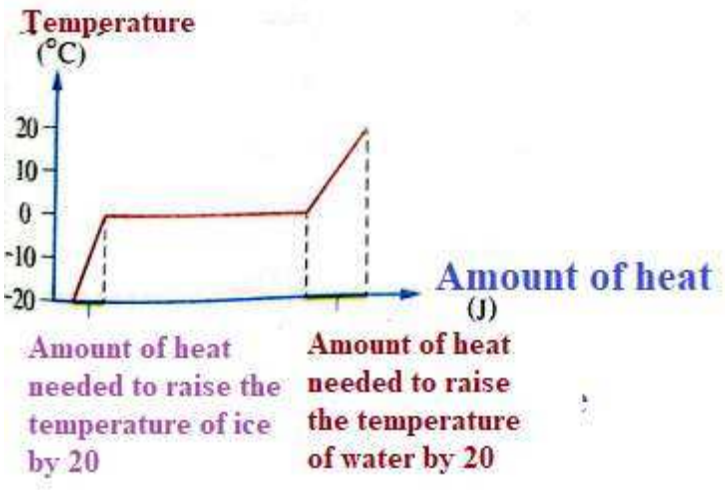
The amount of temperature change of equal masses of different states of the same substance differs when they gain or lose the same amount of thermal .energy
- يختلف مقدار التغير في درجة حرارة الكتل المتساوية من الحالات المختلفة من نفس المادة عند اكتسابها أو فقدها نفس الكمية من الطاقة الحرارية

### In this activity

**Control variable** المتغير الضابط
Amount of heat gained, mass of the substance
كمية الحرارة المكتسبة، كتلة المادة

**Independent variable** المتغير المستقل
Physical state of the substance
الحالة الفيزيائية للمادة

**Dependent variable** المتغير التابع
Amount of temperature change
مقدار التغير في درجة الحرارة




Explanation

The amount of temperature increase in a block of ice is greater than the amount of temperature increase in the same mass of water when they gain the same amount of thermal energy. Explain
مقدار الارتفاع في درجة حرارة كتلة من الثلج يكون أكبر من مقدار الارتفاع في درجة حرارة نفس الكتلة من الماء عند اكتسابهما نفس كمية الطاقة الحرارية ... علل ؟

Because the specific heat of ice is less than the specific heat of water
لأن الحرارة النوعية للثلج أقل من الحرارة النوعية للماء



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# Unit One, Lesson (3)

## 1- Write Scientific term

1- Which part of the universe is the subject of study and observation of the change in energy and matter in it (…….)
2-The space surrounding the system with which energy, matter, or both can be .exchanged (…….)
3-A system in which an exchange of energy and matter occurs with the surroundings .(…….)
4-A system in which an exchange of energy without matter occurs with the surroundings (…….)
5-A system in which no exchange of energy or matter occurs with the surroundings .(…….)
6-The measure of the average is the kinetic energy of the particles of the system (…….)
7-The sum of the potential and kinetic energies of the particles of the system (…….)
8- The amount of heat required to raise the temperature of 1 kg of matter by IC Factors (…….)
9-The cooling system connected to car engines(…….)

## 2-Complete the following sentences with appropriate words

1-The substance in the system may be ……..or liquid or ……...a mixture of them
2- Systems are classified according to their ability to exchange energy and matter with the surroundings into a…… closed system and …….
3-An exchange of energy occurs in both…….and ……. systems
4-No exchange of matter occurs in both both…….and ……. systems
5-The internal energy of system it the sum of the ……... and ……. energies
6-The kinetic energy of the particles of the materials…… is as largest, because they are moving……
7-When a material gains an amount of thermal energy……. the average kinetic energy of its particles, and therefore ……. its temperature
8-The potential energy of a ……. material is as largest, while for……. materials is almost zero
9-The body gains thermal energy. ……its temperature, while the body loses thermal energy……. its temperature
10-The amount of change in the temperature of any body depends on……. the type of material and …….
11-The amount of change in the temperature of different masses of the same material differs when……. or……. the same amount of thermal energy
12-When two equal masses of water and oil are heated over a uniform flame, the amount of temperature increase in…… is greater than in…..……


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13-When the specific heat of a substance is large, the amount of heat needed to raise its temperature is……and take time …… the loss is the energy it has gained

## 3-Correct underline

1-An open system exchanges energy only with its surroundings
2-Bottles of soda water represent an isolated system
3-Heat is a measure of the average kinetic energy of the particles of a substance
4-A decrease in the average speed of the particles of a substance is offset by a constant temperature
5-Murcury are an excellent coolant liquid
6-The specific heat of ice is equal to the specific heat of liquid water
7-Radiators are used to protect car tires from damage

## 4-Put a (✓) and an (X) and correct it

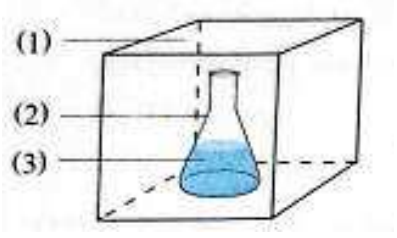
1-An open system has only exchange of matter with the surrounding medium ( )
2-A thermos represents a closed system ( )
3-The temperature of a substance is a measure of the average kinetic energy of its particles ( )
4-The average kinetic energy of the particles of a system leads to an increase in its temperature ( )
(5) The average kinetic energy of the particles of hot water is equal to the average kinetic .energy of the particles of cold water ( )
6-The average kinetic energy of the particles in a system is equal to the kinetic energy of a single particle, assuming the kinetic energy of all particles is equal( )
7-Heat transfer from or to a body is inferred from the change in its temperature ( )
8-The amount of change in the temperature of a body increases with an increase in its mass when it gains a quantity of heat( )
9-The specific heat of a single substance varies according to its physical state ( )

## 5-Choose the correct answer from the given answer

1-What is the relationship between a closed system and the surrounding medium
a. Both matter and energy are exchanged between them
b. An exchange of matter but not energy is exchanged between them
c. Energy is exchanged between them without matter
d. No exchange of matter or energy takes place between them

2-What is the relationship between an isolated system and a collective section
a. Only heat is exchanged between them
b. Both matter and heat are exchanged between them
c. Only matter is exchanged between them
d. Neither matter nor heat is exchanged between them

3-In the opposite figure
Which number represents the system and the system boundary, respectively?




a. (1).(2) b.(2).(3)
c. (1).(3) d. (3).(2)



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4-The opposite figure shows three pots containing equal masses of tea with a temperature of 70 CC
Which of the following is true after 20 minutes

a. The temperature of the tea does not change in the pot (1). The mass of the tea decreases in the pot (2)
b. The mass of the tea does not change in the pot (1). The temperature of the tea decreases in the pot (2)
c. The temperature of the tea does not decrease in the pot (2). The mass of the tea does not change in the pot (3)
d. The mass of the tea does not change in the pot (1) (1). The temperature of the tea does not change in the pot (3)

5-A system containing a substance (A) with a mass of 5 was dissolved in 30 ml of water. At the end of the experiment, the temperature of the solution decreased by 3 and its mass was 35. What type of system is this

a. Isolated b. Closed c. Open d. Closed or isolated

6-The internal energy of the system increases when

a. The potential energy of its particles increases
b. Both the potential energy and kinetic energy of its particles decrease
c. The kinetic energy of its particles decreases
d. Its particles stop moving

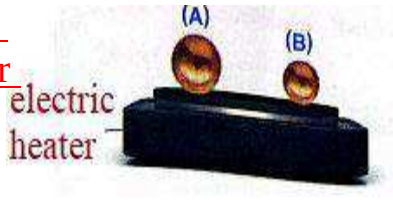
7-When a substance is heated, the body that makes it up dies

a. Its average kinetic energy decreases
b. Its average kinetic energy increases
c. Its potential energy increases
d. Its internal energy decreases

8-All of the following are factors affecting the temperature of a system, except

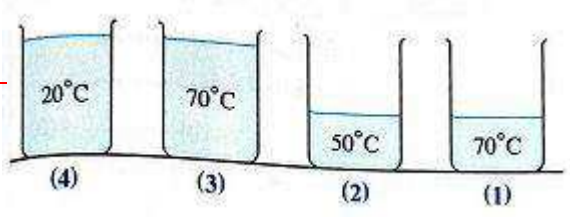
a. Its mass b. Its type of substance c. Its shape d. Its physical state

9-The opposite figure represents the heating process of two copper balls (A and B). Which of the two balls has a greater temperature rise over the same period of time




a. Ball (A), due to its high specific heat
b. Ball (B), due to its high specific heat
c. Ball (A), due to its large size
d. Ball (B), due to its small size

10-From the opposite pots
What two vessels should the experiment be carried out on to demonstrate the relationship between the time required for water to reach boiling point and the mass of water




a. (3).(4) b.(1).(4) c. (2).(3) d. (1).(3)



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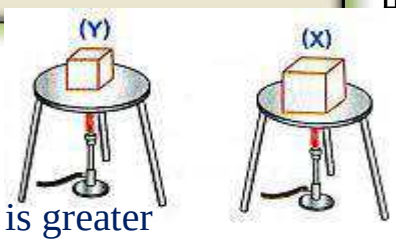
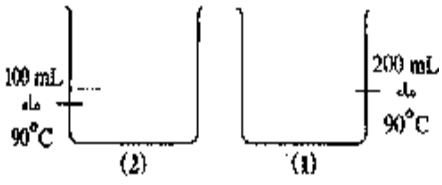
11-The opposite figure: represents the heating process of two cubes of the same material. Which of the following is true when they reach 60ºC?



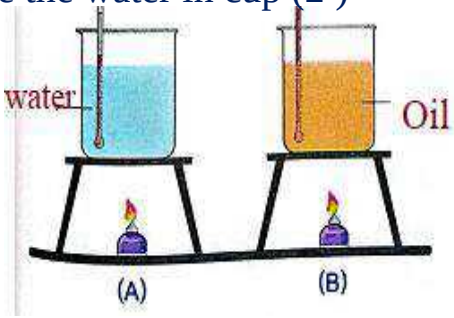

a. Cube (Y) has more thermal energy because its specific heat is greater
b. Cube (Y) has less thermal energy than cube (X)
c. Cube (X) has less thermal energy than cube(Y)
d. Cube (X) has more thermal energy because its specific heat is lower

12-From the opposite figure
Which of the following is true




a. The water in the two cups has the same amount of heat
b. The water in cup (2) is colder than the water in cup
c. The internal energy of the water in cup (1) is less than the water in cup (2)
d. The water in cup (1) reaches room temperature before the water in cup (2 )

13- The opposite figure: represents an experiment to measure one of the factors affecting the amount of change in the temperature of the system
What is the independent variable in this experiment




a. The volume of oil and water
b. The amount of heat gained
c. The type of substance of the oil and water
d. The amount of change in the temperature of the oil and water

(14) When two equal masses of water and ice are heated with a uniform flame the amount of temperature rise will be

a. Water is the largest
b. Ice is the largest
c. Water and ice are both equal in both states
d. Its amount is twice that of ice

15-The specific heat of a metal ball depends on

a. Its type of substance
b. Its mass
c. Its volume
d. Its radius

16-Which of the following materials has the largest specific heat

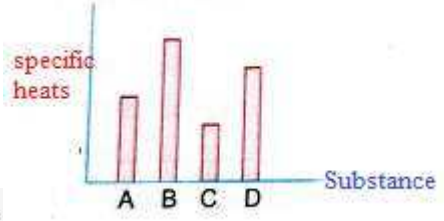
a. Water
b. Iron
c. Aluminum
d. Mercury

17-The table opposite shows the values of the specific heats of four elements with the same temperature
Which element's temperature rises at the fastest rate when equal masses of each are supplied with the same amount of heat for an equal period of time

| Element | Specific Heat (J/kg.°C) |
|---|---|
| Al | 900 |
| Cu | 385 |
| Fe | 450 |
| C | 410 |

a. Al
b. Cu
c. Fe
d. C

18-The graph opposite expresses the specific heat of solids (A) (B) (C) (D) equals in mass at room temperature 25, which of these substances reaches a temperature of 70 in the greatest possible time




a. (A)
b. (B)
c. (C)
d. (D)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Essay Questions

## 6-What is meant by each of

1-The system 2- The surrounding medium
3-Open system 4-Closed system
5- Isolated system 6- temperature
7-Internal energy of the system 8-Specific heat
9-Radiator

## 7-Give reasons for the following

1-A hot cup of tea represents an open system

……

2-A vacuum saucepan represents a closed system, while a thermos represents an isolated system

……

3-A medical thermometer is considered a closed system

……

4-The kinetic energy of the particles of solids is small, while the kinetic energy of the particles of gases is very high

……

5-The temperature of a liquid decreases when it loses thermal energy

……

6-The speed of diffusion of odors in hot air is greater than their speed of diffusion in cold air

……

7-The internal energy of any isolated system is constant

……

8-The amount of temperature rise in a single substance decreases with an increase in its mass when it gains a quantity of heat

……

9-When two equal masses of oil and water are heated by the same heat source, the amount of temperature rise in the oil is greater than that in the water

……

10-Specific heat is a characteristic property of a substance

……

11-Mercury is used in the manufacture of thermometers

……

12-Water is an excellent refrigerant

……

13-Water is used in a car radiator

……

14-The human body contains a large percentage of water



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……

## 8-What happens when

1-The system gains thermal energy from the surroundings

……

2-Two different masses of distilled water are heated - each separately - to the same temperature for an equal period of time using a uniform flame

……

3-Two equal masses of water and oil are heated - each separately - to the same temperature for an equal period of time using a uniform flame

……

4-Two equal masses of water and ice are heated - each separately - for an equal period of time using a uniform flame

……

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# lesson (4) Methods of Heat Transfer

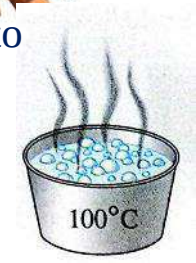
## Heat Flow

Heat Flow When a pot of boiling water at 100°C is placed in a room at 250°C, the water quickly cools down over time. G.R.?

Because thermal energy is transferred from the water (system) to the room (surroundings) and is known as heat.

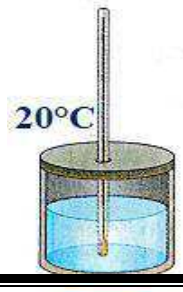
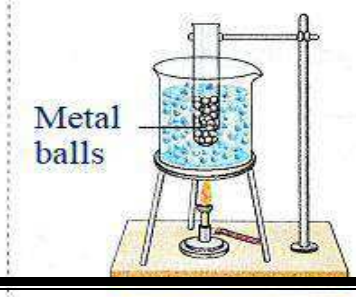
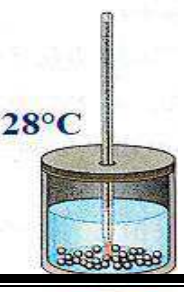
**Heat** Energy that is transferred from one system to another or to the surroundings due to a difference in temperature.

الحرارة الطاقة التي تنتقل من نظام إلى آخر أو إلى المناطق المحيطة بسبب اختلاف درجات الحرارة




## Practical Activity How Heat Flows:

Steps

| 1-Record the temperature of a quantity of water in an insulated pot, using a thermometer | 2-Place metal balls in a boiling water bath for a certain period of time until the temperature of the balls rises. | 3-Transfer the metal balls from the boiling water to the cold water and re-record their two temperatures together. |
|---|---|---|
|   |   |   |
| Recorded temperature 20°C | Recorded temperature 100°C | Recorded temperature 28°C |

### Observation

The temperature of the cold water increases from 20 to 28°C

The temperature of the metal balls decreases from 100 to 28°C -

The temperature of the mixture of water and metal balls together is now 28°C

Note The temperature of the water rises at a slower rate, while the temperature of the metal balls decreases at a faster rate,

Because the specific heat of the water is greater than the specific heat of the metals

ملاحظة: ترتفع درجة حرارة الماء بمعدل أبطأ، بينما تنخفض درجة حرارة الكرات المعدنية بمعدل أسرع،

لأن الحرارة النوعية للماء أكبر من الحرارة النوعية للمعادن



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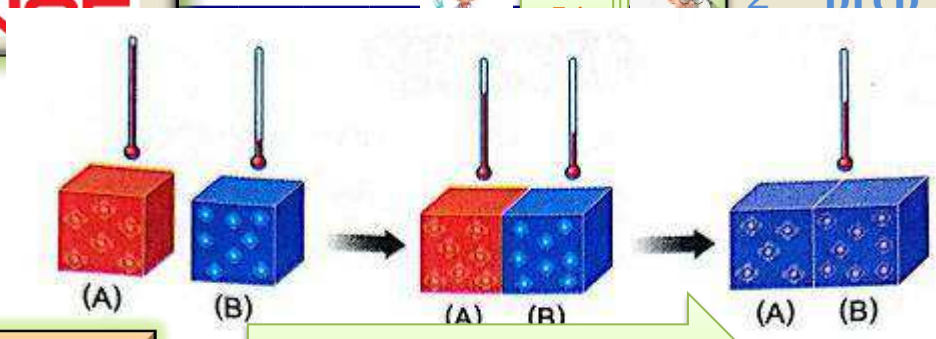
Conclusion

.




**(What happened),**

Direction of heat flow

When two non-isolated systems with different temperatures come into contact

thermal energy flows from the higher temperature system to the lower temperature system

( ماذا يحدث ) عند تلامس نظامين غير معزولين مختلفين فى درجة الحرارة تسرى (تنتقل) الطاقة الحرارية من النظام الأعلى في درجة الحرارة إلى النظام الأقل في درجة الحرارة

Heat flow continues between the two systems until they reach the same temperature, i.e., they reach thermal equilibrium.

يستمر سريان ( تدفق ) الحرارة بين النظامين حتى يصبح لهما نفس درجة الحرارة، أى يصلا لحالة الاتزان الحرارى.

**Thermal Equilibrium** The state reached by two systems with different temperatures after they come into contact and their temperatures become equal.

الاتزان الحرارى الحالة التي يصل إليها نظامين مختلفين فى درجة الحرارة بعد تلامسهما وتساوى درجتي حرارتهما

Notes The amount of heat lost from one system = the amount of heat gained in the other system (at equilibrium).

كمية الحرارة المفقودة من أحد النظامين - كمية الحرارة المكتسبة في النظام الآخر ( عند الاتزان ).

When two equal masses or volumes come into contact Of the same material and different temperatures

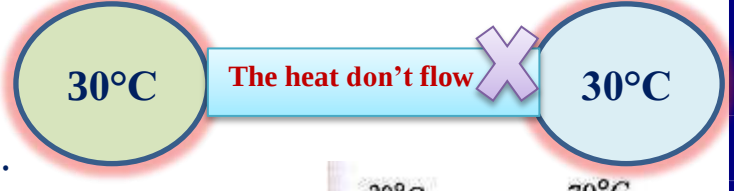
عند تلامس كتلتان أو حجمان متساويين من مادة واحدة ومختلفين في درجة الحرارة الجاء سريان الحرارة.

At thermal equilibrium, the temperature of each of them =their average temperatures before contact are equal to (40°C).

تصبح درجة حرارتهما عند الاتزان الحراري، متوسط درجتي حرارتهما قبل التلامس.(40°C)

When two bodies with the same temperature come into contact

عند تلامس جسمان لهما نفس درجة الحرارة.

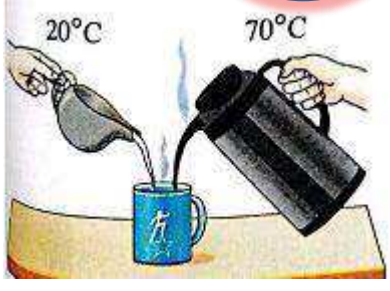



Note that does not change لا يحدث سريان للحرارة.

When a Nescafe drink with a temperature of 70°C comes into contact with a milk drink with a temperature of 20°C, (What happened),

We notice that the temperature of the mixture formed .in the cup is greater than 20°C and less than 70°C

عند ملامسة مشروب نسكافيه درجة حرارته 70°C المشروب لبن درجة حرارته 20°C نلاحظ أن درجة الخليط المتكون فى الكوب تكون أكبر من 20°C وأقل من 70°C





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G.R. When metal balls with a temperature of 30°C are mixed with water with a temperature of 20°C, the temperature of the mixture at thermal equilibrium is not 25°C

س فسر : عند خلط كرات معدنية درجة حرارتها 30°C مع ماء درجة حرارته 20°C، لا تكون درجة حرارة الخليط عند الاتزان الحراري 25°C

Because the mixture is composed of two substances that differ in mass and type, and therefore in specific heat

لأن الخليط مكون من مادتين مختلفتين في الكتلة والنوع وبالتالي في الحرارة النوعية

## Methods of heat transfer

| First Conduction | Second: Convection | Third Radiation |
|---|---|---|

### First: Heat transfer by conduction

When: you touch a metal spoon placed in a cup of hot tea

then

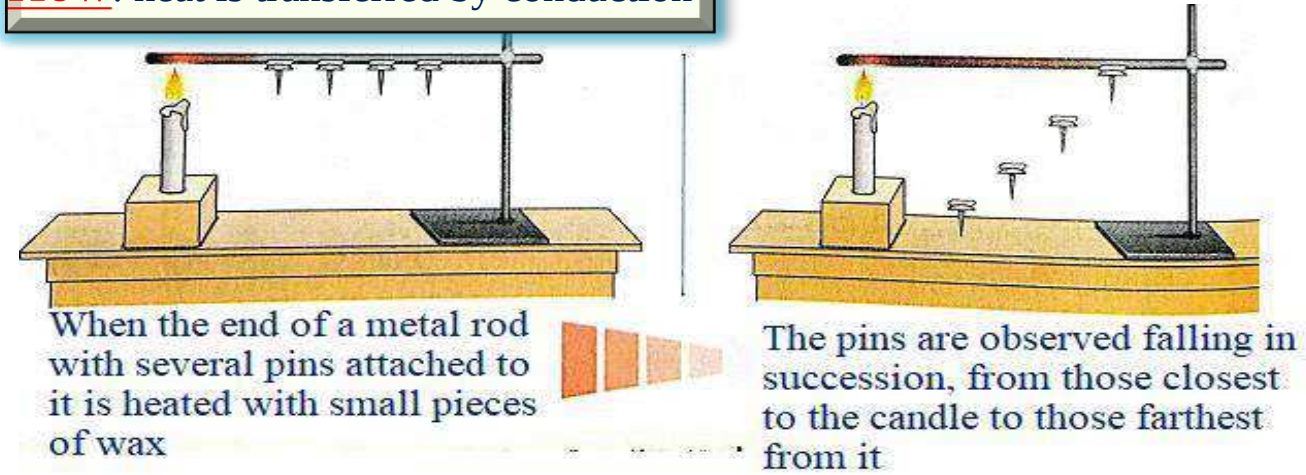
The heat flows from the tea to the spoon and from the spoon to your hand

in a way known as

**thermal conduction**

Heat transfer by conduction

### How: heat is transferred by conduction



When the end of a metal rod with several pins attached to it is heated with small pieces of wax

The pins are observed falling in succession, from those closest to the candle to those farthest from it

Heat is transferred along the metal rod from the higher to the lower temperature point by conduction

حيث تنتقل الحرارة على امتداد الساق المعدنية من النقطة الأعلى إلى النقطة الأقل في درجة الحرارة بالتوصيل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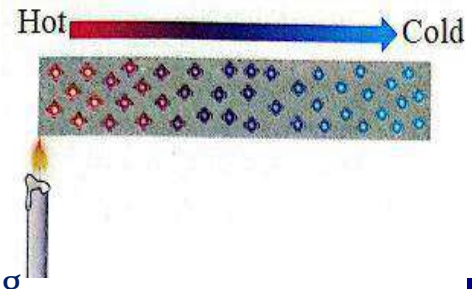
# Explaining heat transfer by conduction. تفسير انتقال الحرارة بالتوصيل

When the tip of a metal rod is heated,
عند تسخين طرف ساق معدنية




The kinetic energy of the particles in it increases, causing it to vibrate more.
تزداد طاقة حركة الجسيمات الموجودة بها، فتهتز بدرجة أكبر

Some of the energy of these particles is transferred when they collide with neighboring particles, increasing the kinetic energy of the neighboring particles.
. . ينتقل بعضًا من طاقة هذه الجسيمات عند تصادمها مع الجسيمات المجاورة لها ، فتزداد طاقة حركة الجسيمات المجاورة،

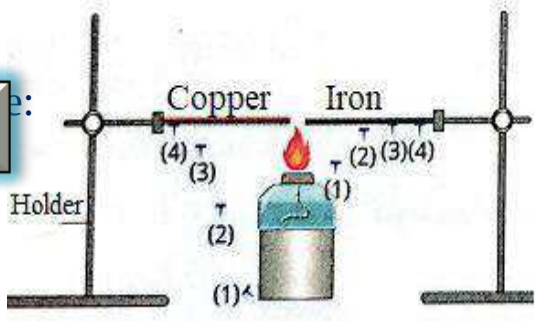
In the same way, some of the energy is transferred to the following particles without the particles moving from their position.
وبنفس الكيفية ينتقل جزء من الطاقة للجسيمات التالية دون أن تنتقل الجسيمات من موضعها

## Thermal conductivity التوصيل الحراري :

The transfer of thermal energy through solid objects from one point to another without the particles moving from their position.
انتقال الطاقة الحرارية خلال الأجسام الصلبة من نقطة إلى أخرى دون انتقال جسيماتها من موضعها

Thermal conductivity A measure of the extent to which a material conducts heat through it.
التوصيلية الحرارية مقياس لمدى قابلية المادة لتوصيل الحرارة خلالها

## In the experiment shown in the opposite figure




Two iron and copper rods of the same dimensions, with pins attached to them, are heated using small pieces of wax.
يتم تسخين ساقين من الحديد والنحاس لهما نفس الأبعاد مثبت عليهما دبابيس باستخدام قطع صغيرة من الشمع.

Observation

The time it takes for the pins to fall varies for each rod, and this depends on the thermal conductivity of the material of each rod.
يلاحظ اختلاف زمن سقوط الدبابيس في كل ساق ويتوقف ذلك على التوصيلية الحرارية لمادة كل ساق

The thermal conductivity of copper is greater than that of iron.
حيث أن التوصيلية الحرارية للنحاس أكبر من الحديد

Therefore, the wax melts first and the pins fall faster.
لذا ينصهر عنده الشمع أولا وتتساقط الدبابيس أسرع

Metals are good conductors of heat. الفلزات مواد جيدة التوصيل للحرارة .

The natural elements are arranged according to their conductivity as follows:
ترتب العناصر الطبيعية حسب توصيليتها ، كالتالي :

First: Diamond. Second: Silver. Third: Copper.
الأول : الماس الثاني : الفضة الثالث : النحاس



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Materials can be classified according to their thermal conductivity into:

| Thermal conductive materials<br>مواد موصلة حراريا | Thermal insulating material<br>مواد عازلة حراريا |
|---|---|
| Good thermal conductors<br>have high thermal conductivity<br>مواد جيدة التوصيل للحرارة توصيليتها الحرارية مرتفعة | Poor thermal conductors<br>have low thermal conductivity<br>مواد رديئة التوصيل للحرارة توصيليتها الحرارية منخفضة |
| Examples<br>Diamonds<br>Metals in general, such as aluminum and copper<br>أمثلة الماس الفلزات بشكل عام مثل : الألومنيوم والنحاس. | Examples<br>Wood<br>-Plastics<br>الخشب البلاستيك<br> |

1- G. R. Pizza is placed in cardboard boxes.

علل : توضع البيتزا في علب من الكارتون ؟

To keep it hot, because cardboard is a heat-insulating material

ج للاحتفاظ بها ساخنة، لأن الكارتون من المواد العازلة للحرارة

2. G. R. Cooking utensils (pots) are made of metals....

تصنع أواني الطهى من المعادن

Because they high thermal conductivity,

لارتفاع توصيليتها الحرارية

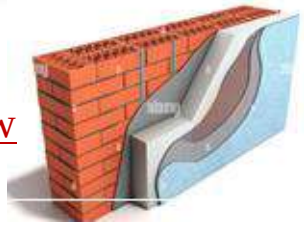
3- G. R. The Cooking pots handles are made of plastic or wood... ?

تصنع مقابض أواني الطهى من البلاستيك أو الخشب

Because of their low thermal conductivity.

لانخفاض توصيليتهما الحرارية.

4- G. R. Polystyrene panels are placed between hollow bricks constructing building walls?



وضع ألواح البولى إستيرين بين قوالب الطوب المفرغ عند تشييد حوائط المباني 4.

Because polystyrene and the air in the brickwork are heat-insulating materials, which prevents rapid changes in temperature inside the room when it changes outside

لأن البولى إستيرين والهواء الموجود في فرغ الطوب من المواد العازلة للحرارة، وهو ما يمنع التغيرات السريعة في درجات الحرارة داخل المناق عند تغيرها خارجها

G. R. The presence of cooling systems inside electronic devices such as computers and smartphones that use materials that conduct heat well Such as silver

وجود أنظمة تبريد داخل الأجهزة الإلكترونية مثل أجهزة الكمبيوتر والهواتف الذكية تستخدم فيها مواد جيدة التوصيل للحرارة مثل الفضة

To get rid of the heat generated in the internal components, which may lead to poor performance and possibly damage.

للتخلص من الحرارة المتولدة في المكونات الداخلية والتي قد تؤدي إلى ضعف أدائها وربما تلفه

١ .



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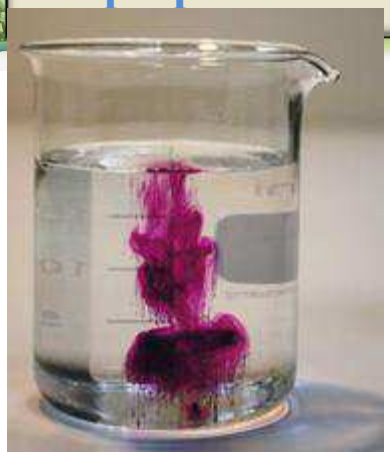
## Second: Heat transfer by Convection



When: crystal of violet potassium permanganate is placed in a beaker containing a quantity of water over a flame

then

The violet-colored water spreads into the beaker during the heating process

by

**Convection cuurent**

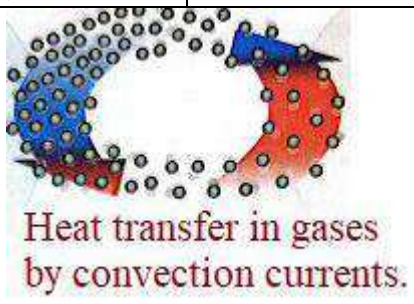
## Explanation Heat Transfer by Convection Currents

| | | | |
|---|---|---|---|
| When water is heated by a heat source, the water particles near the bottom of the container gain thermal energy, so the particles move faster and further apart. | the hot water rises because its density is less than that of the cold water | And the cold water(higher density) located at the surface descends to replace the hot water | Reply the rise of hot water and the fall of cold water |
| عند تسخين الماء بمصدر حرارى تكتسب جسيمات الماء القريبة من قاع الإنا طاقة حرارية فتتحرك الجسيمات بسرعة أكبر وتبتعد عن بعضها أكثر | يرتفع الماء الساخن الأعلى ، لأن كثافته تكون أقل من كثافة الماء البارد | والماء البارد (ذو الكثافة الأعلى) الموجود على السطح ينزل ليحل محل الماء الساخن. | يستمر صعود الماء الساخن وهبوط الماء البارد |

## gases

When air is cooled
its density increases, so it descends and is replaced by hotter (lower density) air

عند تبريد الهواء تزداد كثافته فيهبط لأسفل ويحل محله الهواء الساخن الأقل كثافة)



Heat transfer in gases by convection currents.

When air is heated
its density decreases, so it rises upwards and is replaced by colder (higher density) air

عند تسخين الهواء تقل كثافته فيرتفع لأعلى ويحل محله الهواء البارد (الأعلى كثافة)



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# Thermal Convection

The transfer of thermal energy in fluids with the movement of their particles

الحمل الحراري انتقال الطاقة الحرارية فى الموائع مع حركة جسيماتها.

(1) (G.R.)The heater is placed on the floor of the room?

توضع المدفأة على أرضية الغرفة علل ؟

By transferring heat from the heater to the air next to it, the warm, less dense air rises upwards and the cold, denser air falls downwards

بانتقال الحرارة من المدفأة للهواء المجاور لها فيرتفع الهواء الدافئ الأقل كثافة الأعلى ويهبط الهواء البارد الأعلى كثافة لأسفل.

(2) (G.R.)The freezer is installed at the top of the refrigerator. ?

يثبت الفريزر في أعلى الثلاجة علل

This ensures even heat distribution throughout the refrigerator by the cold, denser air fall downwards and the warm, less dense air rising upwards

الضمان توزيع الحرارة فى جميع أنحاء الثلاجة بهبوط الهواء البارد الأعلى كثافة لأسفل وصعود الهواء الدافئ الأقل كثافة لأعلى.

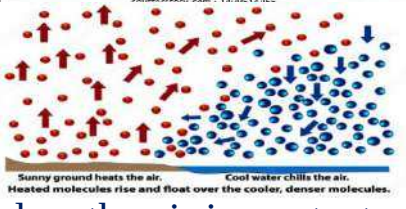
# Sea Breeze

نسيم البحر

The movement of cold air (breeze) from the sea during the day towards the land

حركة هواء بارد (نسيم) من البحر نهارا باتجاه اليابس نسيم البحر

The Sea Breeze Phenomenon. ظاهرة نسيم البحر




(3) (G.R.)The reason of Sea Breeze occur?

The specific heat of land is lower than the specific heat of sea water

سبب حدوث نسيم البحر : انخفاض الحرارة النوعية لليابس عن الحرارة النوعية لماء البحر

How it occurs. (1) When the sun's rays fall during the day, the air in contact with the land heats up more than the air in contact with the sea.

(1) عند سقوط أشعة الشمس نهارًا يسخن الهواء الملامس لليابس بدرجة أكبر من سخونة الهواء الملامس للبحر.

(2) The hot air above the land rises upwards and is replaced by cold air (breeze) from the sea.

(2) يرتفع الهواء الساخن الذي يعلو اليابس لأعلى ويحل محله هواء بارد (نسيم) من جهة البحر

The effect of this phenomenon is more evident in the summer than in the spring or autumn

(G.R.)How can an eagle fly in the air at great heights?

كيف يستطيع النسر التحليق في الهواء على ارتفاعات كبيرة ؟

The air near the Earth's surface is heated by the sun's heat, causing the warm air rise upwards. The eagle spreads its wings to rise with the air without having to flap its wings. This is equivalent to the force of gravity and maintains its buoyancy in the air.

يسخن الهواء القريب من سطح الأرض بفعل حرارة الشمس فتتصاعد تيارات حمل الهواء الدافئ لأعلى فيبسط النسر جناحيه ليرتفع لأعلى مع الهواء دون الحاجة إلى رفرفة الجناحين وهو ما يعادل قوة الجاذبية الأرضية له ويحافظ على طفوه في الهواء



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للتخلص من الحرارة المتولدة في المكونات الداخلية والتي قد تؤدي إلى ضعف أدائها وربما تلفها .

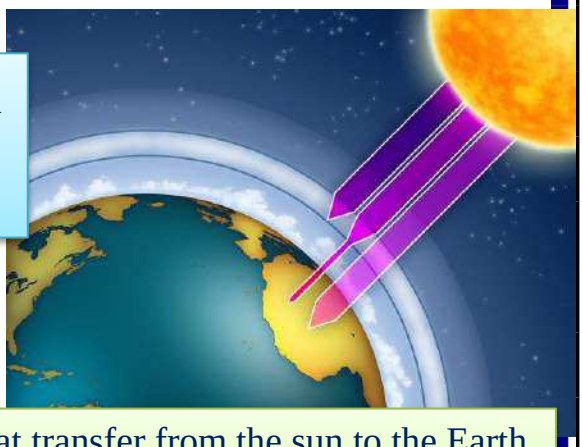
## Third: Heat transfer by Radiation

When: exposed to solar radiation, we feel warm even though there are millions of kilometers of space between the sun and the Earth (G.R.)?

The sun's heat is transferred to us without the need for material particles.

known as

**Radiation**



Heat transfer from the sun to the Earth by radiation

## Explanation of Heat Transfer by Radiation

1-Solar radiation consists of many electromagnetic waves, some of which are visible, such as light, and some of which are invisible, such as infrared radiation with a thermal effect.

يتكون الإشعاع الشمسي من العديد من الموجات الكهرومغناطيسية بعضها مرئى . مثل الضوء وبعضها غير مرئى مثل الأشعة تحت الحمراء ذات التأثير الحراري.

Electromagnetic waves:- Waves that propagate in a vacuum at a very high speed, reaching 300,000 m/s in all directions

الموجات الكهرومغناطيسية موجات تنتشر في الفراغ بسرعة كبيرة جدا تصل 300000 m/s في جميع الاتجاهات

2-Objects absorb infrared radiation, so their temperature rises.

تمتص الأجسام الأشعة تحت الحمراء، لذا ترتفع درجة حرارتها .

Opaque, upright objects absorb infrared radiation better than shiny white objects.

يكون امتصاص الأجسام المعتمة القائمة للأشعة تحت الحمراء أفضل من امتصاص الأجسام البيضاء اللامعة .

Therefore: - Firefighters wear shiny, clear clothing.

لذا : - يرتدى رجال الإطفاء ملابس قضية لامعة.

In the summer, we wear white or light-colored clothing,

In the winter, Dark clothing. Solar water heater tubes are painted black.

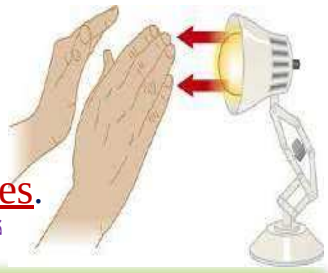
ترتدى في الصيف ملابس بيضاء أو فاتحة وفي الشتاء ملابس قائمة. تطلى أنابيب السخانات الشمسية باللون الأسود.

1-All hot objects radiate heat (infrared rays), and the hotter the object, the more infrared rays it emits.

كل الأجسام الساخنة تشع حرارة (أشعة تحت حمراء ) وكلما كان الجسم أسخن كلما زادت الأشعة تحت الحمراء الصادرة عنه

2-All heat sources emit heat, which is transmitted through the air by radiation and convection, while heat from the sun is transmitted by radiation only.

كل المصادر الحرارية تنبعث منها الحرارة وتنتقل منها خلال الهواء بالإشعاع والحمل، بينما تنتقل الحرارة من الشمس بالإشعاع فقط.



Heat is transmitted from the lamp to the hand by radiation.

That is, heat is transmitted by radiation in a vacuum and in gases.

تنتقل الحرارة من المصباح إلى اليد عن طريق الإشعاع ، أى أن الحرارة تنتقل بالإشعاع في الفراغ وفي الغازات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In light of the above, radiation can be defined as follows:

## Thermal radiation.

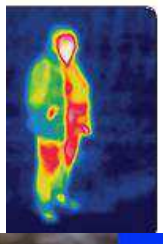
The transmission of infrared rays from the surfaces of objects, especially hot ones, without the need for material particles.

الإشعاع الحراري.انتقال الأشعة تحت الحمراء من أسطح الأجسام، وخاصة الساخن منها، دون الحاجة إلى جسيمات مادية

## Thermography

A technology that uses a camera to sense the thermal radiation emitted by objects and convert it into color images. The colors depend on changes in the body's temperature.

الثرموجراف تقنية تستخدم كاميرا تعمل على استشعار الإشعاع الحراري الصادر من الأجسام وتحويله إلى صور ملونة، تعتمد ألوانها على التغيرات فى درجات حرارة الجسم.

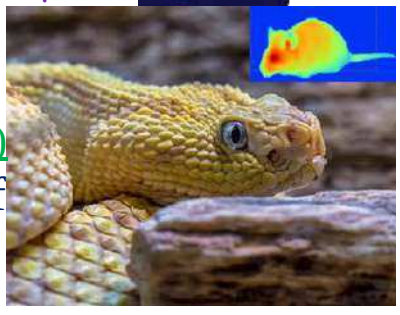


The thermograph camera is used تستخدم كاميرا الثرموجراف

-Photography in the dark. التصوير في الظلام .

-Detecting the temperature of objects.الكشف عن درجة حرارة الأجسام .

## Integration with Biology_التكامل مع علم الأحياء (البيولوجي)



Snakes are able to hunt their prey at night (G.R.) because there are sensory sensors in the front of the snake's head that enable it to receive infrared radiation emitted by the prey's bodies.

تتمكن الثعابين من اصطياد فرانسها ليلا ... لوجود مستشعرات حسية في مقدمة رأس الثعابين تمكنها من استقبال الأشعة تحت الحمراء الصادرة من أجسام الفرانس

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Objective questions

## Unit One, Lesson (4)

### 1- Write Scientific term

1)The energy that transfer from one system to another as a result of the difference in their temperature. (……)
2)The state in which 2 different systems differ in their temperature and touching each other where their temperature becomes equals (……)
3) Transfer of heat energy through solid bodies without the moving of their molecules from their position (……)
4)The measurement of the ability of substance to transfer energy. (……)
5)Transfer of heat energy in fluids with moving its particles (……)
6)Movement of cold air at day from sea to land (……)
7)Waves transfer in space in all direction by speed of 300000 Km/S (……)
8)The transfer of infrared rays from the surface of hot bodies without the need of materialistic particles (……)
9)A Technique in which a camera use the sense of thermal waves emitted from bodies and change it into colored photos. (……)

### 2)Complete the following

(1) Thermal energy is transferred from a…… system at a temperature to a ……. system at a temperature.
(2) Heat is transferred in three different ways conduction,……. And……
(3) Heat is transferred from one point to another in…… objects by…….
(4) From materials that are good conductors of heat…… . while…… is from materials that are heat insulators.
(5) Cooking pot handles are made of……. Or ……while the pots themselves are made of…….
(6) Silver precedes by ……..element and follows by ……..element in thermal conductivity.
(7) Sheets of…… are placed between bricks to avoid…… temperature changes inside buildings.
(8) Heat is transferred by conduction as a result of…….. particles of a material touching each other, while heat transferred by convection as a result ……..of particles of a fluid.
(9) Heat is transferred in iron by……., While it is transferred in water by……..
(10) Hot water has ……..density while cold water has ……..density .
(11) A sea breeze occurs as a result of the movement of hot air from……
to be replaced by cold air from……
(12) The idea of the sea breeze depends on the transfer of heat by a……
, while the cooling of electronic devices depends on the transfer of heat by a……
(13) Heat is transferred in gases by a…… and ……. method



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(14) The heat of the sun reaches us by a……. method, while the heat of a heater reaches us by a……and…… method.

(15)…….. camera. can sense the…….. radiation emitted by objects and convert it into colored images.

## 3)Correct the underlined:

(1) Heat is a form of matter. (……)

(2) Heat is transferred through solid objects from one end to the other by convection. (……)

(3) When two identical cubes of copper come into contact, the temperature of the first being 60 °C and the temperature of the second being 40°C, their temperature at thermal equilibrium becomes 20 °C. (……)

(4) Copper ranks first in thermal conductivity among natural elements (……)

(5) When heat is transferred by radiation, hot water particles rise upward and cold water particles sink downward. (……)

(6) The effect of the sea breeze phenomenon is more pronounced in spring.

(7) Infrared radiation has a chemical effect. (……)

(8) The idea of wearing clothes that stand out in winter is based on heat transfer by conduction. (……)

(9) When we stand in front of a lit electric lamp, heat is transferred to us by conduction. (……)

## 4)Put ( ✓) or (X) , and correct the wrong:

(1) The transfer of thermal energy from one system to another depends on a temperature difference between them. ( )

(2) Heat is transferred from a colder body to a hotter body. ( )

(3) A spoon becomes cold after being used to stir iced water in a cup because the spoon loses heat to the iced water. ( )

(4) When a cube of metal at a temperature of 60°C is dropped into a tub of water at a temperature of 90°C, there is no change in the temperature of the water. ( )

(5) When stirring a cup of hot tea with a metal spoon, heat is transferred to the hand by radiation. ( )

(6) Thermal equilibrium occurs when there is a difference in the amount of heat. ( )

(7) Metals are thermal conductors. ( )

(8) The thermal conductivity of copper is greater than that of silver. ( )

(9) The thermal conductivity of solid bricks is better than that of hollow bricks.

(10) The heat generated in smartphone components leads to poor performance. **( )**

(11) Heat is transferred through solids and liquids by convection. ( )

(12) When air is cooled, its density decreases and it sinks. ( )

(13) An electric heater is placed on the floor of a room to heat the air by conduction.( )



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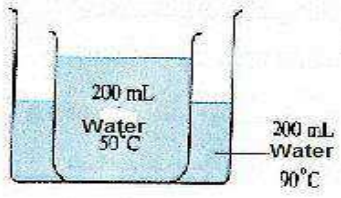
## 5)Choose the correct answer from the given answers:

(1) When an ice cube is placed in boiling water.
A)Heat is transferred from the water to the ice.
B) The water acquires energy from the ice.
C)The water acquires energy from the surroundings.
D)Coldness is transferred from the ice to the water

(2) We feel cold after entering an air-conditioned room for several minutes, because….
a)The body loses heat. b)The room air loses heat.
c)The body gains heat. d)The air conditioner gains heat.

(3) When an object (X) with a temperature of 75°C comes into contact with another object (Y) with a temperature of 1500°C, heat is transferred.
a) From (X) to (Y) when thermal equilibrium is reached.
b) From (Y) to (X) when thermal equilibrium is reached.
C)from (X) to (Y) until thermal equilibrium is reached.
d) From (Y) to (X) until thermal equilibrium is reached.

(4) The opposite figure shows a beaker of water placed in a basin of water.
What is the temperature of the water in the beaker and basin after 5 hours?
a) Beaker: 90°C , Basin: 50°C b) Beaker: 50°C , Basin: 50°C
c)Beaker: 70°C , Basin: 70°C d) Beaker: 50°C , Basin: 70°C



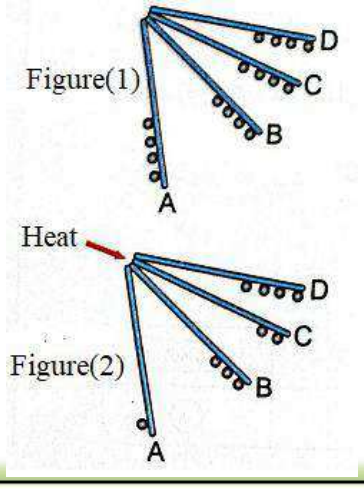

(5) Heat is transferred through metal objects by……
a)Conduction and convection. B)Radiation only.
c)Radiation and convection. D) Conduction only.

(6) When ironing clothes with an electric iron, heat is transferred from the soleplate to the clothes, by…….
a)Convection currents and radiation b)Radiation only.
c)Convection currents only. d) Conduction only.

(7) All of the following are good conductors of heat, except for…….
a)Iron. b) Copper. c )Aluminum. D) Wood

(8) The amount of thermal conductivity can be clearly distinguished between each of….
a)Iron and copper. b)Copper and aluminum
c)Wood and plastic. d)Iron and plastic.

(9) In Figure (1), metal balls of the same material were glued with wax to several stems of different materials. When heat was supplied to them, some of the balls fell off As in Figure (2),which of the stem materials is considered the most heat conductive?
(A) A (B) B (C) C (D)D



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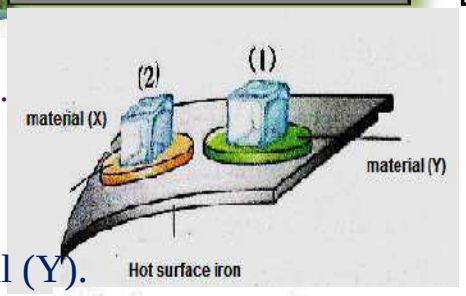
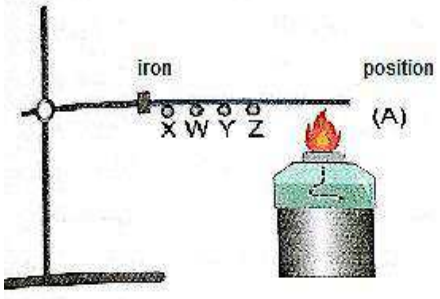
(10) From the experiment shown in the opposite figure:
Ice cube (2) melts completely before ice cube (1) because …




a)Material (X) conducts heat faster than material (Y).
b)Material (Y) is a better conductor of heat than material (X).
C)The ice cube on material (Y) loses heat faster.
d)Material (X) has the same thermal conductivity as material (Y).

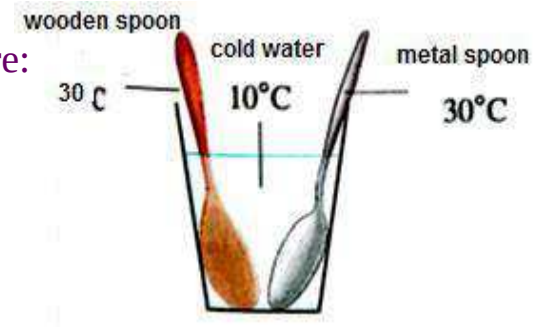
(11) The opposite figure: represents an iron rod, on which are attached4 identical balls of wax heated from position (A). What is the order of the wax balls in terms of melting speed?




a. Z>Y>X>W
b. W>Z>Y>X
c. W>X>Z>Y
d. Z>Y>W>X

(12) A metal door handle (X) is cooler than another plastic door handle (Y) on a cold day. because handle (X)……
a)conducts convection currents more than handle (Y).
b)More conductive than the handle (Y).
c)Less conductive than handle (Y).
d)Better radiant of heat than the handle (Y).

(13) From the experiment shown in the opposite figure:
What is the possible temperature of each of the two spoons two minutes after placing them in cold water?



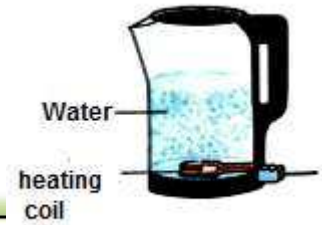

| Choices | Wooden spoon | metal spoon |
|---|---|---|
| A | 25°C | 18°C |
| B | 12°C | 28°C |
| C | 30°C | 30°C |
| D | 10°C | 10°C |

(14) Heat is transferred by convection in all of the following except:…….
a)Chlorine. b ) Water. C)Air. D) Aluminum.

(15) When air is heated, it……
a)Its density decreases and it sinks. b)Its density increases and it rises.
c)Its density decreases and it rises. d)Its density increases and it sinks.

(16) Covering a cup of hot tea with a lid makes it retain its heat for as long as possible, because this reduces its density.
a)Conduction through the cup b)Convection currents above the surface of the tea.
c)Convection currents in the tea. d)radiation from the shiny surface of the cup

(17) In an electric kettle, the heating coil is placed near the base of the kettle, because…….
a) Cold water rises b)Hot water rises.
C) The kettle is a poor conductor of heat.



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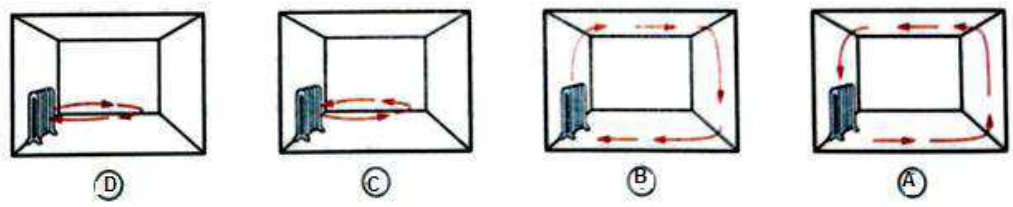
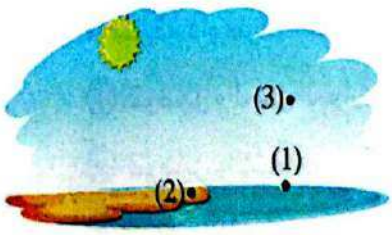
d) Water is a good conductor of heat.

(18) An electric heater was placed on the floor of a room, Which of the following figures represents the air movement in the room after turning on the heater?

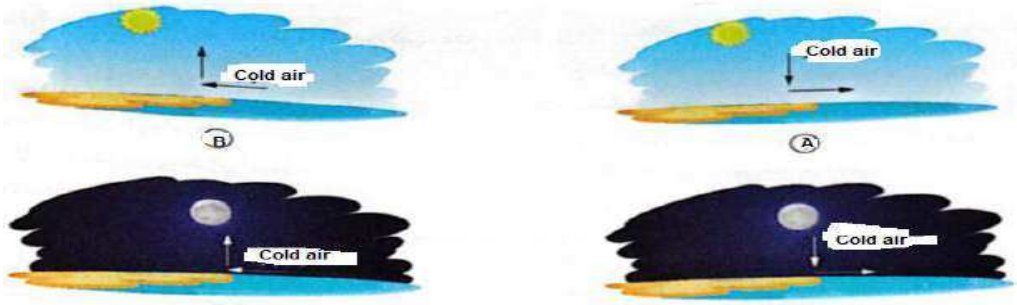



(19) The opposite figure shows three locations where the temperature varies. The correct order of these locations according to their temperature at noon is:




a)1<3<2 b) 3<1<2 c) 1<2<3 d) 2<1<3

20)Which of the following figure represent mechanism of forming sea breeze

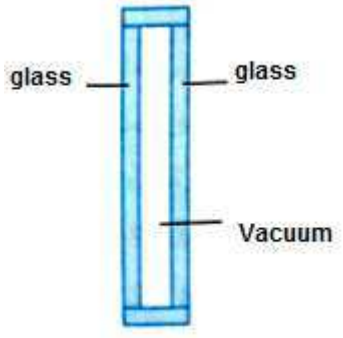



(21) Heat transfer by radiation occurs through……..

a)Liquids only. b) Material and immaterial media.

C ) Gases only. d)Metals only.

(22) In which of the following cases is heat transferred by radiation only?




a)Heating a pot of water using a stove.

b) Heating a piece of rock by the sun.

C) Heating the air in a room with a radiator.

d)Heating hands when rubbed together.

(23) Which of the following is true?

a)Metals conduct heat equally.

b)Heat is transferred in solids and liquids by convection currents.

c)The density of a cold liquid is greater than its density when it is hot.

d)Infrared radiation has a chemical effect.

(24) From the figure opposite: Which method (or methods) of heat transfer is prevented by a vacuum?

a) Conduction and convection.

b) Conduction and radiation.

c) Convection and radiation.

d) Radiation only.



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25) In the following figure :- Rami and Atef set around burning wood to feel warm At an equal distance , how heat can transfer to each of them ?

| Choices | Rami | Atif |
|---|---|---|
| A | Convection | radiation |
| B | Convection and radiation | radiation |
| C | radiation | Convection and radiation |
| D | radiation | Convection |

26) Homes in hot houses painted with white color , because white color……

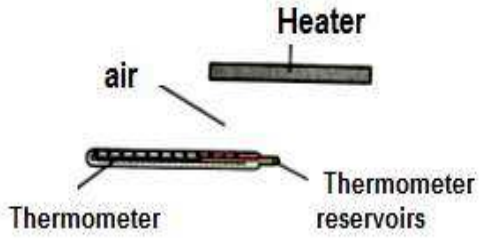
a) reflect rays b)transfer rays c)absorb rays d) allow rays to pass

27)From the following figure , what is the method of transferring heat from the heater to thermometer storage

(a) Conduction , convection and radiation

(b) Conduction and radiation

(c) Convection only (d) radiation only




## 6)Choose between the 2 columns :-

1)

| (A) Heat transfer through | (B)Through |
|---|---|
| 1)solid | 1) radiation |
| 2)gases | 2) Conduction and Convection |
| 3)Vacuum | 3) Conduction |
| | 4) Convection and radiation |

2)

| (A) Heat transfer | (B)Through |
|---|---|
| 1)On touching a metallic spoon | 1) Conduction and radiation |
| 2)From the warmer to the room atmosphere | 2) radiation |
| 3)From sun to us | 3) Convection |
| | 4) Conduction |

## Essay Questions

## 7)What is meant by:

(1) Heat

(2) Thermal equilibrium

(3) Thermal conduction

(4) Thermal conductivity

(5) Convection

(6) Sea breeze

(7) Radiation

(8) Electromagnetic waves



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## 8)Give reasons for the following:

(1) The temperature of a cold solid object rises when it touches a hot piece of iron.

.....

(2) The temperature of a hot piece of metal decreases when it is placed in a cup of cold water.

.....

(3) Cooking utensils are made of aluminum, but their handles are made of wood

.....

(4) It is preferable to place polystyrene panels between bricks when constructing walls.

.....

(5) When constructing walls, it is preferable to use hollow clay bricks over solid clay bricks.

.....

(6) Electronic devices have cooling systems that use materials that conduct heat well.

.....

(7) An eagle can soar at great heights without flapping its wings, despite the Earth's strong pull.

.....

(9) It is preferable to place an electric heater on the floor of a room.

.....

(8) Heat is not transferred by convection through solid materials

.....

(10) The freezer is placed at the top of the refrigerator.

.....

(11) The sea breeze occurs.

.....

(12) The sand on the beach is hotter than the sea water at noon.

.....

(13) The sun's heat is transmitted to us by radiation.

.....

(14) The sun's heat is not transmitted to us by conduction or convection.

.....

(15) It is preferable to wear tight clothes in the winter and light clothes in the summer.

.....

(16) Painting solar water heater tubes black.

.....

(17) Firefighters wear shiny silver clothes.

.....

(18) Thermograph cameras are used at airports.

.....



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(19) Snakes can catch their prey at night.

……

## 9)What happens when:

1-A hot metal block is immersed in a cup of water that is cold relative to the temperature of the metal block and the water?

……

(2) Two bodies at the same temperature come into contact.

……

(3) Two non- insulated systems at different temperatures come into contact

……

(4) Mixing a hot drink at 700°C with another drink at 20°C

……

(5) Placing a metal spoon in a cup of hot tea.

……

(6) Heating the end of a metal rod with several pins attached to it with small pieces of wax.

……

(7) Using polystyrene insulation panels between the walls of buildings during construction.

……

(8) Placing a heater at the top of a room.

……

## 10)Compare between each of the following:

(1) Thermally conductive materials and thermally insulating materials in terms of: Definition - Examples.

(2) Copper and plastic in terms of: Thermal conductivity.

(3) Hollow clay bricks and solid clay bricks in terms of: Thermal conductivity.

(4) Solid and liquid materials in terms of: The method of heat transfer through them.

(5) Heat transfer by conduction, convection, and radiation in terms of: The possibility of heat transfer in a vacuum

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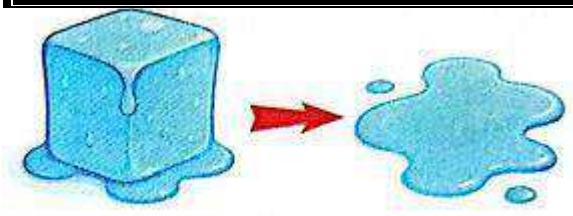
# Unit (2) Matter and Chemical Reactions

## lesson (1) Chemical Reactions

### Chemical Reactions

| Physical Changes التغيرات الطبيعية | Chemical Changes التغيرات الكيميائة |
|---|---|
| A physical change is a change in the state or shape of matter without altering its chemical composition.<br>التغيير الفيزيائي هو تغيير في حالة المادة أو شكلها دون تغيير تركيبها الكيميائي. | A chemical change results in substances with new chemical properties different from those of the original materials<br>يؤدي التغير الكيميائي إلى ظهور مواد جديدة ذات خصائص كيميائية مختلفة عن خصائص المواد الأصلية |
| milting of ice | Burning of wood |



Classify the following changes as physical or chemical changes:

1) Dissolving sugar in water.
2) Milk turning into yogurt.
3) Burning of wax.
4) Melting of wax.
5) Rusting of an iron nail.
6) Burning a piece of bread in the oven.
7) Clouding of clear limewater when carbon dioxide gas is passed through it.
8) Change in color of a moistened universal indicator strip when exposed to ammonia gas.

(1), (4): Physical Changes
(2), (3), (5), (6), (7), (8): Chemical Changes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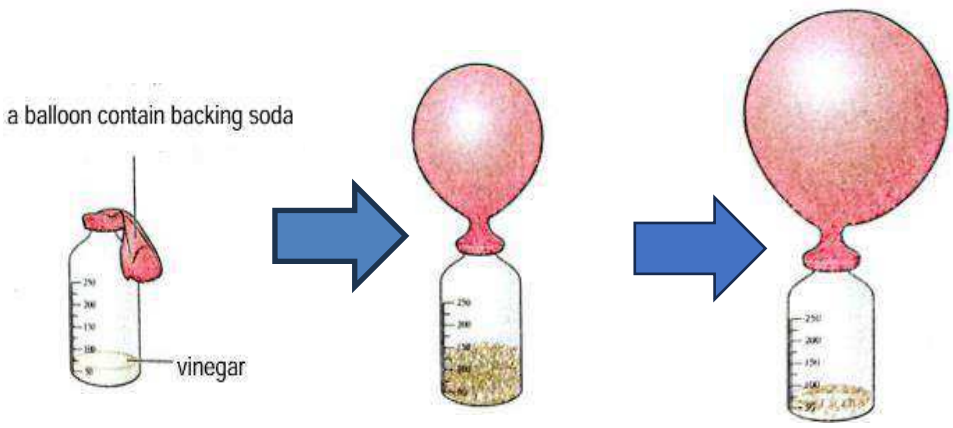
# Chemical Reactions

## Activity 1: Concept of Chemical Reaction

Materials and Tools Used: Baking soda (sodium bicarbonate)
Vinegar (diluted acetic acid)- Balloon- Funnel Empty bottle




:

### Steps

1-Put two spoons of baking soda into the balloon.
2- Pour some vinegar into the bottle.
3- Insert the balloon's mouth into the bottle's mouth.
4- Lift the balloon to pour the baking soda into the bottle.

### Observation الملاحظة :

Effervescence occurs and gas bubbles rise, causing the balloon to expand and fill with gas يحدث فوران وترتفع فقاعات الغاز، مما يؤدي إلى تمدد البالون وامتلاءه بالغاز

### Explanation التفسير :

The chemical reaction between baking soda (sodium bicarbonate) and vinegar (diluted acetic acid) results in effervescence and the release of carbon dioxide gas.
يؤدي التفاعل الكيميائي بين صودا الخبز (بيكربونات الصوديوم) والخل (حمض الأسيتيك المخفف) إلى فوران وانبعاث غاز ثاني أكسيد الكربون.

## Mechanism of Chemical Reaction

## Chemical Reaction

A process that involves the transformation of

| Chemical substances (reactants) | **into** | Other Chemical substances (products). |
|---|---|---|

In a chemical reaction, the reactants combine, break apart, or replace one another to form new products.



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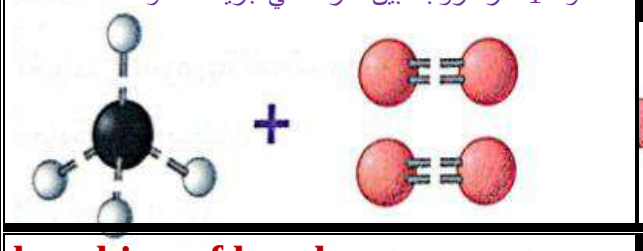
# Mechanism of Chemical Reaction

## Step 1:
Breaking the bonds between atoms in the molecules of the reactants.

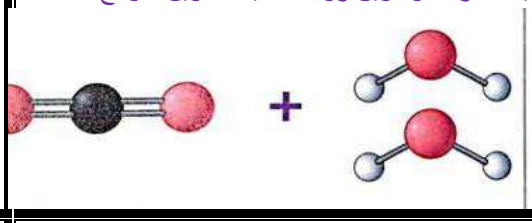
الخطوة 1كسر الروابط بين الذرات في جزيئات المواد المتفاعلة



**breaking of bonds** between atoms in the molecules of the **reactants**

## Step 2:
Rearranging the atoms and forming new bonds to create the products.

الخطوة 2إعادة ترتيب الذرات وتكوين روابط جديدة لتكوين النواتج.



**formation of new bonds** between atoms in the molecules of **the products**

# Chemical Reaction

A process breaking of bonds between atoms in the molecules of the reactants and the formation of new bonds between atoms in the molecules of the products

التفاعل الكيميائي عملية تتضمن كسر الروابط بين الذرات في جزيئات المواد المتفاعلة وتكوين روابط جديدة بين الذرات في جزيئات المواد الناتجة.

# Properties of Substances Before and After a Chemical Reaction

خواص المواد قبل وبع التفاعل الكيميائي

The properties of substances change before and after a chemical reaction, as demonstrated in the following activity:

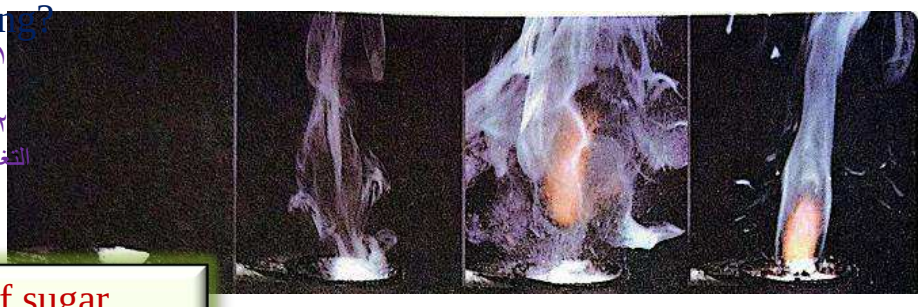
## Activity 2: Burning Sugar

1-Place a quantity of table sugar in a combustion dish. What are the observable properties of sugar?

2-Heat the sugar slowly by placing the dish over a flame. What changes occur in the properties of sugar after burning?

١- ضع كمية من سكر المائدة في طبق احتراق. ما هي خصائص السكر الملحوظة؟

٢- سخّن السكر ببطء بوضع الطبق فوق اللهب. ما هي التغيرات التي تطرأ على خصائص السكر بعد الاحتراق؟



## Observation:

### Observable properties of sugar
**الخواص الظاهرية للسكر:**

Odorless White solid مادة صلبة بيضاء عديم الرائحة

**During burning:** اثناء الاحتراق

A strong smell develops and smoke rises تظهر رائحة قوية

Sugar gradually turns into a brown molten substance يتحول السكر للون بني منصهر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After complete combustion بعد الاحتراق

A black solid substance (carbon) remains

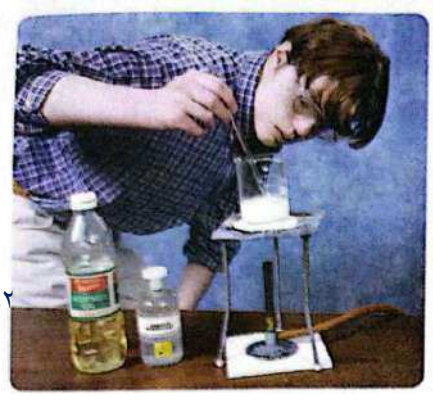
Smoke rises Color change

Properties of substances (sugar) before and after the reaction, as shown in the following table

| | Properties of substances before the reaction | Properties of substances after the reaction |
|---|---|---|
| Color | White solid | Black substance |
| Odor | Odorless | Strong odor and smoke |

## Activity 3 : Reaction of Oil with Caustic Soda

### Steps:



1-Place 100 ml of oil in a glass beaker.

2-Add 30 ml of caustic soda solution (concentrated sodium hydroxide solution) to the oil drop by drop.

١- ضع ١٠٠ مل من الزيت في دورق زجاجي.

٢- أضف ٣٠ مل من محلول الصودا الكاوية (محلول هيدروكسيد الصوديوم المركز) إلى الزيت قطرةً قطرةً.

3- Heat the mixture using a suitable heat source to a temperature between 40°C and 50°C, stirring the components well in one direction.

٣- سخّن الخليط باستخدام مصدر حرارة مناسب إلى درجة حرارة تتراوح بين ٤٠ و٥٠ درجة مئوية، مع تحريك المكونات جيدًا في اتجاه واحد.

What change occurs in the properties of the substances after the reaction?

ما التغيير الذي يحدث في خصائص المواد بعد التفاعل؟

**Observation:** The texture changes over time, and the mixture transforms into a new solid substance.

الملاحظة: يتغير الملمس مع مرور الوقت، ويتحول الخليط إلى مادة صلبة جديدة

**Conclusion:** The texture of the substance changes before and after the reaction, as shown in the following table.

الاستنتاج: يتغير ملمس المادة قبل التفاعل وبعده، كما هو موضح في الجدول التالي.

| | Properties of substances before the reaction | Properties of substances after the reaction |
|---|---|---|
| state | Oil: Liquid<br>Concentrated sodium hydroxide solution Liquid | Soap: Solid |

### Indicators of a Chemical Reaction

الدلائل على حدوث تفاعل كيميائي:

1-Formation of a precipitate 2. Gas evolution 3. Change in color

4-Emission of light and heat 5. Emission of odor 6. Change in texture

1- تكوين راسب 2- تطور الغاز 3- تغير اللون 4- انبعاث الضوء والحرارة 5- انبعاث الرائحة 6- تغير الملمس



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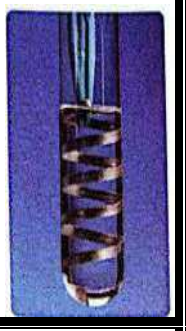
| Indicators | Chemical Reaction | Evidence of chemical reaction |
|---|---|---|
| 1-Formation of a Precipitate | Adding silver nitrate solution ($AgNO_3$) to sodium chloride solution (NaCl) | A white precipitate of silver chloride (AgCl) forms, which is insoluble in water and settles at the bottom of the container. |
| 2. Gas Evolution | Adding diluted hydrochloric acid (HCl) to a strip of magnesium (Mg)  | Bubbles of hydrogen gas are formed |
| 3. Change in Color of the Substance | Placing a zinc plate (Zn) in copper(II) sulfate solution ($CuSO_4$) | → The blue color of the copper sulfate solution disappears, forming a colorless zinc sulfate solution, and red copper precipitates on the zinc plate. |
| 4.Emission of Light and Heat | A strip of magnesium (Mg) ignites in atmospheric air | turns into magnesium oxide (MgO), which is soluble in water. |

What safety precautions should be followed when handling a strip of magnesium

ما احتياطات السلامة الواجب اتباعها عند حرق شريط من المغنسيوم

1- Hold the magnesium strip with tongs to avoid burns during heating.

امساك شريط المغنسيوم بماسك حراري

2- Use a protective mask to shield the eyes and entire face.

3-Do not touch the white powder formed immediately after the reaction, as it may be hot.

لاتلمس المسحوق الأبيض المتكون بعد التفاعل لانه يكون ساخن



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What safety precautions should be followed when adding acids to metals?

ما احتياطات السلامة الواجب اتباعها عند إضافة حمض الي الفلزات

Handle acids with great care specially the concentrated one.

تعامل بحرص شديد مع الاحماض وخاصة المركزة منها

What indicates a chemical reaction when sugar is burned?

1-Colour change Smoke emission

2-Formation of a new substance with a strong odor (carbon)

-What indicates a chemical reaction when oil reacts with caustic soda?

-Formation of a new substance (soap) - texture change

What indicates a chemical reaction when baking soda reacts with a diluted acid?

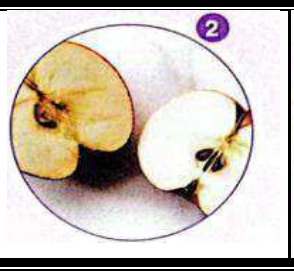
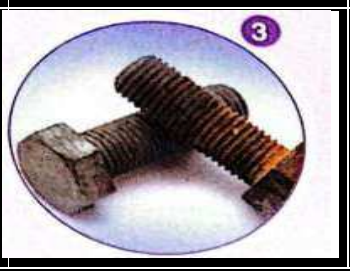
Emission of carbon dioxide gas bubbles

What indicates a chemical reaction between carbon dioxide gas and clear limewater (calcium hydroxide solution)?

The clear limewater becomes cloudy when carbon dioxide gas is passed through it.

## Chemical Reactions in Life التفاعلات الكيميائية فى حياتنا

Examples of chemical reactions in daily life:

| 1-Frying eggs | 2. Reaction of oxygen in the air with apple slices when cut and left exposed to air | 3.Rusting of iron when exposed to humid air | 4.Ignition of fireworks |
|---|---|---|---|
| |  |  | |
| Evidence of a chemical reaction | | | |
| The color and texture of both the egg white and yolk change | The color of the apple changes To brown | The color of the iron changes | Emission of light and heat |

Do the following changes indicate a chemical reaction? How can this be determined?

1. A water bottle filled to the brim and tightly sealed is placed in a refrigerator.

No, because the expansion of water during freezing does not result in a change in the chemical composition of the water or the glass.

**2. A rotting orange.** Yes, due to the change in color of the orange and the emission of a foul odor

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Objective questions

## Unit Two, Lesson (1)

### 1- Write Scientific term

1) A change in the state or shape of a substance without altering its chemical composition. (……)
2) Results in new substances with properties different from those of the original materials. (……)
3) A gas produced from the reaction of sodium bicarbonate with diluted acetic acid. (……)
4) Breaking the bonds between atoms in the molecules of the reactants and forming new bonds between atoms in the molecules of the products. (……)
5) A white precipitate that turns purple when exposed to sunlight. (……)
6) A solid substance produced from the reaction of oil with caustic soda solution. (……)
7) Change in the color of iron when exposed to moist atmospheric oxygen(……)

### 2-Complete the following statements :

Dissolving sugar in water is a ……. change, while burning sugar is a ……. change.
A chemical reaction involves the transformation of ……. substances into ……. substances.
Indicators of a chemical reaction include the formation of a ……. that is insoluble in water and the emission of light or …….
The scientific name of backing soda is ……., while the scientific name of vinegar is …….
The reaction of vinegar with baking soda is identified by the formation of ……. gas.
(6) When silver chloride precipitate is exposed to sunlight, it changes from the color …… to the color …….
(7) Copper sulfate solution is …… in color, while zinc sulfate solution is …….
(8) When zinc is added to copper sulfate solution, a …… solution is formed and …… precipitates.
(9) The combustion of a magnesium ribbon in atmospheric air is accompanied by the emission of ……. Magnesium chloride is …… in water, while magnesium oxide is …… in water.
(11) The color of sugar before burning is ……, while after burning it becomes …….
(12) When a mixture of oil and sodium hydroxide solution is heated, it changes from the …… state to the …… state.
(13) Soap is formed from the reaction of ..... with .....
(14) When frying an egg, the color and texture of both the ..... and the ..... change, indicating a chemical reaction.



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## 3-Correct the underlined statements:

1) A chemical reaction between sulfuric acid and sodium bicarbonate is indicated by the formation of a precipitate.
2) When silver nitrate solution is added to sodium chloride solution, a white precipitate of sodium nitrate is formed.
3) When magnesium oxide is exposed to sunlight, it turns violet.
4) Copper sulfate solution is colorless.
5) The scientific name of caustic soda is sodium bicarbonate.
6) Copper rusts when exposed to moist atmospheric oxygen.

---

## 4-Put a (✓) or (X) and the correction wrong

1 .Physical changes do not alter the chemical composition of a substance.( )
2.Melting wax produces a new substance. ( )
3.Chemical changes result in new substances with properties different from those of the original materials. ( )
4.The transformation of milk into yogurt is evidence of a physical change. ( )
5.The crust formed during cooking is evidence of a chemical change. ( )
6. The rotting of bread and fruits over time is evidence of a chemical reaction. ( )
7.All chemical reactions are accompanied by the formation of bonds between atoms of the reactant molecules. ( )
8.Magnesium sulfate powder is white and insoluble in water. ( )
9.Burning sugar changes its physical properties. ( )

---

## 5-Choose the correct answer from the given options:

(1) All of the following represent a chemical change, except:
a) Fruit rotting b) Burning a piece of bread in the oven
c) Bursting a balloon filled with air d) Turning milk into yogurt
(2) When a quantity of salt is dissolved in water:
a) A new substance is formed b) The salt loses its taste
c) A chemical change occurs d) A physical change occurs
(3) What happens when a piece of chocolate is left exposed to sunlight for a short time?
a) A strong burning smell is emitted b) Its color changes
c) Its taste changes d) It melts without changing its composition
(4) All of the following changes result in the formation of new substances, except:
1) Frying an egg 2) Melting ice 3) Burning fuel 4) Iron rusting
(5) Gas bubbles form when diluted acetic acid is added to baking soda. All of the following occur, except:
a) A new substance is formed b) change the properties of baking soda and acetic acid
c) A physical change occurs d) A chemical change occurs



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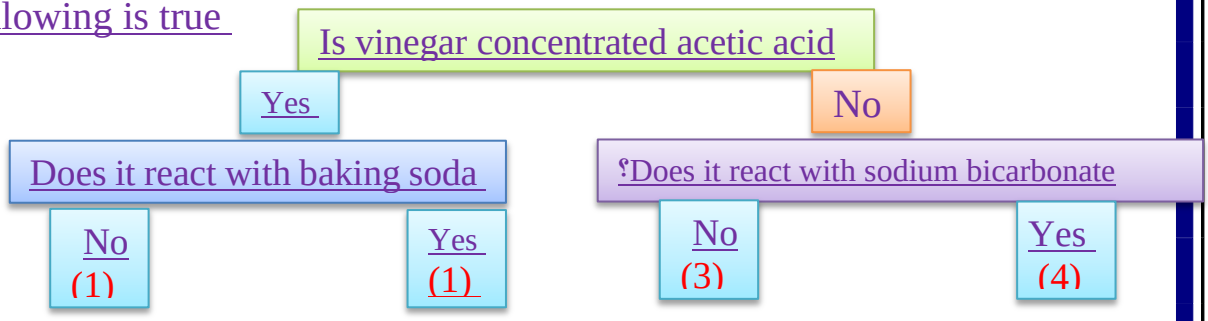
6) Hydrochloric acid reacts with sodium hydroxide to form sodium chloride (salt) and water. Which of the following best represents the chemical reaction that occurred?

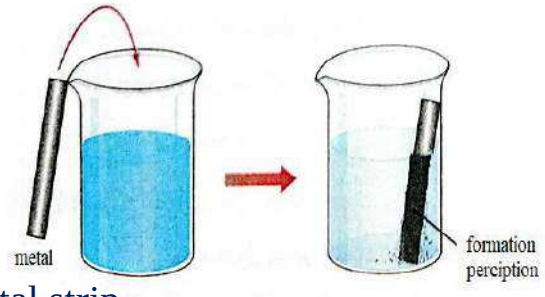
| Options | Breaking the bonds between the atoms of the molecules | Breaking the bonds between the atoms of the molecules |
|---|---|---|
| a. | Hydrochloric acid and sodium chloride | Sodium hydroxide and water |
| b. | Hydrochloric acid and sodium hydroxide | Sodium chloride and water |
| c. | Sodium chloride and water | Hydrochloric acid and sodium hydroxide |
| d. | sodium chloride and sodium hydroxide | Hydrochloric acid and water |

7-From the diagram opposite
Which of the following is true
a. (1)
b. (2)
c. (3)
d. (4)




8- Which of the following is true for both soap and oil?
a. They have the same chemical properties
b. They have the same physical properties
c. Soap is the reactant and oil is the product
d. Soap is the product and oil is the reactant

9.From the adjacent figure:
Can we infer that a chemical reaction has occurred?




a. No, because the metal strip is still present
b. Yes, because a new substance has formed on the metal strip
c. No, because the solution is still blue
d. Yes, because the volume of the solution has not changed

10. All of the following are definite indicators of a chemical reaction, except:
a) Change in the color of the substance b) Emission of odor
c) Change in the volume of the substance d) Emission of light and heat

(11) The reaction of zinc with blue copper sulfate solution is indicated by:
a) Disappearance of the blue color and formation of a green precipitate
b) Disappearance of the blue color and formation of a reddish-brown precipitate
c) Formation of white powder and emission of bright light
d) Formation of white powder and emission of smoke

(12) A chemical reaction is indicated when dilute hydrochloric acid is added to a strip of magnesium by
a) Release of gas bubbles $H_2$ b. Formation of a white precipitate
c) Formation of gas bubbles of $CO_2$ d) Formation of a black precipitate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(13) The following reactions were carried out:
(1) Burning a strip of magnesium
(2) Adding silver nitrate solution to sodium chloride solution
(3) Adding hydrochloric acid to a strip of magnesium
-Which of these reactions is accompanied by the formation of a white substance?
a. Only: (1) b. only(2) c. (1) , (3) d. (1) , (2)

(14) You have the following materials:
Cu Zn ZnSO4 CuSO4
Which of the following represents the reactants and products of these materials?

| Choices | Reactants | Products |
|---|---|---|
| a. | Zn - Cu | ZnSO4 - CuSO4 |
| b. | CuSO4 - Cu | ZnSO4- Zn |
| c. | CuSO4 - Zn | ZnSO4 -Cu |
| d. | ZnSO4- Zn | ZnSO4 Cu |

15. When sugar is burned, all of the following occur except:
a. It gradually turns into a brown melt b. A precipitate forms
c. A caramel smell appears d. Smoke rises

16. Soap is produced from the reaction of:
a. Oil and sodium hydroxide solution b. Oil and solid sodium chloride
c. Oil and sodium chloride solution d. Oil and solid sodium hydroxide

17-It is proven that a chemical reaction occurs when making soap from
a. precipitate formed b. change in texture c. Emitting an odor d. Gas rising

18-Which of the following expresses the type of change that occurs to a piece of apple and a piece of new apple left in the humid air

| Choices | Piece of apple | Piece of iron |
|---|---|---|
| a. | Physical change | Physical change |
| b. | Physical change | chemical change |
| c. | chemical change | Physical change |
| d. | chemical change | chemical change |

19-The color changes in each of the following cases, except
a. Iron rusts b. Expose copper sulfate solution to sunlight
c. Frying an egg d. Expose the silver chloride precipitate to sunlight

## Essay Questions

### 6-Define the following terms:

1-Physical change
2-Chemical change
3-Chemical reaction



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## 7-give reason

1-Melting ice is considered a physical change.

……..……..……..……..……..

2-Burning wood is considered a chemical change.

……..……..……..……..……..

3-A tightly sealed water bottle breaks when placed in a freezer, but no chemical reaction occurs.

……..……..……..……..……..

4-Chemical reactions are accompanied by the formation of new substances.

……..……..……..……..……..

5-Gas bubbles form when sodium bicarbonate is added to acetic acid.

……..……..……..……..……..

6-A white precipitate forms when silver nitrate solution is added to sodium chloride solution.

……..……..……..……..……..

7-A color change occurs in the reaction between zinc and copper sulfate solution.

……..……..……..……..……..

8-No reaction occurs when diluted hydrochloric acid is added to a strip of magnesium.

……..……..……..……..……..

9-Gas bubbles form when magnesium reacts, so a protective mask must be used.

……..……..……..……..……..

10-The white powder formed after burning a strip of magnesium should not be touched immediately.

……..……..……..……..……..

11-Iron rust does not form easily except after a long period, which indicates a chemical reaction.

……..……..……..……..……..

12-Black smoke rises when sugar is burned.

……..……..……..……..……..

13-A solid substance forms when a liquid mixture of oil and caustic soda solution is heated.

……..……..……..……..……..

14-Iron rusts when exposed to moist atmospheric oxygen.

……..……..……..……..……..

## 8-What do you observe when:

1. Baking soda is added to diluted sulfuric acid.
2. Silver nitrate solution is added to sodium chloride solution.
3. Silver nitrate solution is exposed to sunlight.
4. Diluted hydrochloric acid is added to sodium carbonate solution.
5. Diluted hydrochloric acid is added to a strip of magnesium.



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6. A strip of magnesium is heated in atmospheric air.
7. A piece of iron is left in the air for a long time.
8. Sugar is burned.
9. An orange liquid is mixed with oil and caustic soda with continuous stirring.
10. Ammonia gas is passed through moist atmospheric air.
11. Apple slices are left exposed to air.

## 9-How can you tell that a chemical reaction has occurred when:

1. Baking soda is added to vinegar.
2. Silver nitrate solution is added to sodium chloride solution.
3. A zinc plate is placed in copper sulfate solution.
4. Diluted hydrochloric acid is added to a strip of magnesium.
5. A strip of magnesium is heated in atmospheric air.
6. Sugar is burned.
7. Iron is exposed to moist atmospheric oxygen.
8. An egg is fried.
9. Oil reacts with caustic soda.
10. An apple is sliced and left in the air.
11. Fireworks are ignited.
12. Carbon dioxide gas is passed through clear limewater.
13. A water-moistened litmus strip is brought near carbon dioxide gas.

## 10-Mention one difference between each of the following (based on what you have studied):

1. Physical change vs. chemical change
2. Silver chloride vs. magnesium oxide
3. Copper sulfate solution vs. zinc sulfate solution
4. Dissolving sugar in water vs. burning sugar

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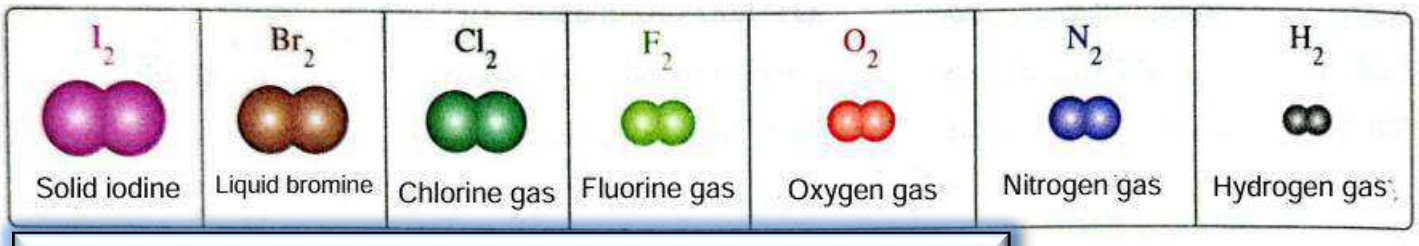
# lesson (2) The Chemical Equation

-

**Most elements in the periodic table exist under normal conditions as** mono-atomic molecules **such as**

**Except for only 7 elements, which exist as** Diatomic molecules namely:




## Ions of Elements and Atomic Groups

| Some Metals and Their Positive ions (Anions) | | Some Non-Metals and Their Negative ions (Cations) | |
|---|---|---|---|
| Lithium | $Li^+$ | Fluoride | F |
| Sodium | $Na^+$ | Chloride | Cl |
| Potassium | $K^+$ | Bromide | Br |
| Silver | $Ag^{1+}$ | Iodide | I |
| Magnesium | $Mg^{2+}$ | Negative atomic groups | |
| Calcium | $Ca^{2+}$ | Hydroxide | $OH^-$ |
| Zinc | $Zn^{2+}$ | Nitrate | $NO_3^-$ |
| Barium | $Ba^{2+}$ | Nitrite | $NO_2^-$ |
| Aluminum | $Al^{3+}$ | Bicarbonate | $HCO_3^-$ |
| Ammonium | $NH_4^+$ | Carbonate | $CO_3^{2-}$ |
| | | Sulfate | $SO_4^{2-}$ |
| | | Sulfite | $SO_3^{2-}$ |
| | | Phosphate | $PO_4^{3=2-}$ |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# Types of Chemical Compounds, How to Write Their Molecular Formulas, and its Example

| Types of Chemical Compounds | How to Write Their Molecular Formulas | Examples |
|---|---|---|
| Acid<br>حمض | It begins with the hydrogen cation ($H^+$), followed on the right by the symbol of the element's ion (except $O^{2-}$) or the formula of the atomic group ion (except $OH^-$). | **$HCl$ – Hydrochloric Acid**<br>**$H_2SO_4$ – Sulfuric Acid**<br>**$HNO_3$ – Nitric Acid** |
| Alkaline<br>قلوي | It begins with the symbol of the element's cation (except $H^+$) or the formula of the cationic atomic group, and ends with the hydroxide anion ($OH^-$). | **$NaOH$ – Sodium Hydroxide**<br>**$Ca(OH)_2$ – Calcium Hydroxide**<br>**$NH_4OH$ – Ammonium Hydroxide** |
| Salt<br>ملح | It begins with the symbol (or formula) of the alkaline cation, which may be a positive ion of a metallic element or a positively charged atomic group, followed by the symbol (or formula) of the acid anion, which may be a negative ion of a nonmetallic element (except $O^{2-}$) or a negatively charged atomic group (except $OH^-$). | **$NaCl$ – Sodium Chloride**<br>**$NH_4Cl$ – Ammonium Chloride**<br>**$NaNO_3$ – Sodium Nitrate**<br>**$(NH_4)_2SO_4$ – Ammonium Sulfate** |

## Notes

The total charge of any compound is zero.

الشحنة الكلية للمركب = صفر

The number of hydrogen atoms in the acid part equals the charge of the anion (or the atomic group) forming it.

عدد ذرات الهيدروجين في الحمض تساوى مقدار شحنة الانيون المكونة له

The number of hydroxide groups in the alkaline part equals the charge of the cation (or the atomic group) forming it.

عدد مجموعات الهيدروكسيد في جزئ القلوي يساوى مقدار شحنة الكاتيون المكون له



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When the same atomic group is repeated in the molecular formula of the compound, the group is written in parentheses, with the number of repetitions written as a subscript outside the parentheses.

عند تكرار نفس المجموعة الذرية في المركب فانها تكتب بين قوسين واسفلها عدد مرات التكرار

## Assess Your Understanding قيم فهمك

Write the molecular formula for each of the following compounds:

1-Silver chloride.....

2-Sodium bicarbonate.....

3-Sodium nitrate.....

4-Copper sulfate.....

5-Hydrochloric acid.....

6-Sodium hydroxide.....

## The Chemical Equation

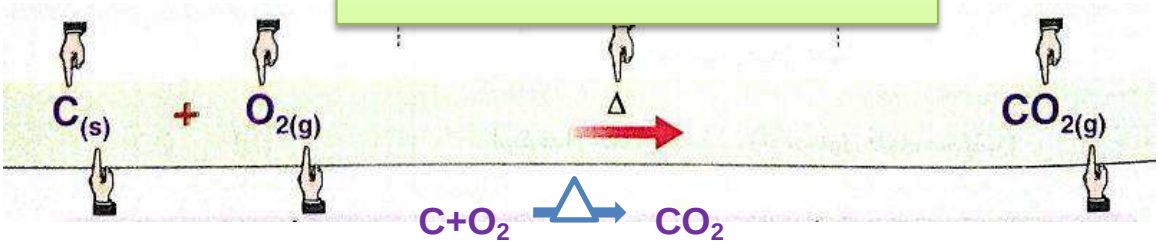
The adjacent diagram represents the combustion reaction of carbon in the presence of oxygen gas, forming carbon dioxide gas.

Scientists thought of simplifying this description of the chemical reaction into a more concise form known as the word equation, in which

1-
Write the name of the reactants on the left side of the equation
كتابة رموز وصيغ المواد المتفاعلة (المتفاعلات) على الجانب الأيسر من المعادلة

2-
Connect the reactants and products with an arrow indicating the direction of the reaction and write the reaction conditions (if it found) above the arrow
الربط بين المتفاعلات والنواتج بسهم يحدد اتجاه سير التفاعل و يكتب فوقه شروط التفاعل إن وجدت

1-
Write the name of the products on the right side of the equation
كتابة رموز وصيغ المواد الناتجة (النواتج) على الجانب الأيمن من المعادلة




Separate each reactant with a plus sign (+)

Writing the physical state of each symbol or formula below it as it appears during the reaction.

فصل كل رد فعل مع علامة زائد (+)

كتابة الحالة المادية لكل رمز أو صيغة تحتها كما يظهر أثناء التفاعل.



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# المعادلة الرمزية The Symbolic Equation

Represents the chemical reaction using symbols and molecular formulas, showing the ratio between the number of atoms or molecules of the reactants and the products formed from the reaction.

تمثيل رمزي للمعادلة الكيميائية باستخدام الموز والصيغ الجزيئية يوضح النسبة بين اعداد الذرات او الجزيئات للمواد المتفاعلة والمواد الناتجة من التفاعل

## Symbols Representing the Physical State of Reactants

| Description | Physical State | Symbol |
|---|---|---|
| Precipitate, powdered salt | Solid | s |
| Condensed gas, water | Liquid | ℓ l |
| Effervescence, bubbles | Gaseous | g |
| Evaporation, dispersion | Vapor | v |
| Substance dissolved in water, acid, alkali | Aqueous solution | aq |

Remember: All metals are solid (s) except for mercury (l), which is the only liquid metal.

Catalyst: A substance that increases the reaction rate without being consumed or changed. المحفز: مادة تزيد من معدل التفاعل دون استهلاكها أو تغييرها.

## Reaction conditions written above the reaction arrow

| Meaning | Symbol |
|---|---|
| Heat (Heating) | Δ |
| Use of a Catalyst | Cat |
| Use of Dilute Acid (or Dilute Alkaline Solution) | dil. |
| Use of Concentrated Acid (or Concentrated Alkaline Solution) | Conc. |

1) Write a symbolic equation for the reaction of sodium bicarbonate with dilute hydrochloric acid, forming sodium chloride solution, water, and carbon dioxide gas, while indicating the physical states of the reactants and products and any reaction conditions, if applicable.

| Formula | Physical State | Description |
|---|---|---|
| $NaHCO_3(s)$ | Solid | Sodium bicarbonate salt. |
| $HCl(aq)$ | Aqueous solution | Diluted hydrochloric acid. |
| $NaCl(aq)$ | Aqueous solution | Sodium chloride solution. |
| $H_2O(l)$ | Liquid | Water. |
| $CO_2(g)$ | Gas | Carbon dioxide gas |

Symbolic Equation $NaHCO_3(s) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l) + CO_2(g)$



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2) Express the reaction between silver nitrate solution and sodium chloride solution using a symbolic equation to show the formation of sodium nitrate solution and a precipitate of silver chloride, including the physical states of the reactants and products, and any reaction conditions if applicable.

| Formula | Physical State | Description |
|---|---|---|
| $AgNO_3(aq)$ | Aqueous solution | Silver nitrate solution. |
| $NaCl(aq)$ | Aqueous solution | Sodium chloride solution. |
| $NaNO_3(aq)$ | Aqueous solution | Sodium nitrate solution. |
| $AgCl(s)$ | Solid (precipitate) | Silver chloride precipitate. |

Symbolic Equation: $AgNO_3(aq) + NaCl(aq) \rightarrow NaNO_3(aq) + AgCl(s)$

Reaction Conditions:

This is a precipitation reaction that occurs at room temperature when two aqueous solutions are mixed.

3) Express the symbolic equation for the thermal decomposition of calcium carbonate to form calcium oxide powder and the release of carbon dioxide gas, including the physical states of the substances and any reaction conditions if applicable.

| Formula | Physical State | Description |
|---|---|---|
| $CaCO_3(s)$ | Solid | Calcium carbonate salt. |
| $CaO(s)$ | Solid | Calcium oxide powder. |
| $CO_2(g)$ | Gas | Carbon dioxide gas. |

Symbolic Equation: $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

Reaction Conditions:

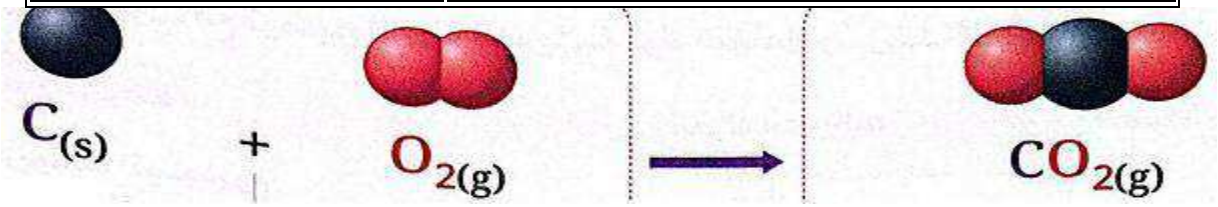
This is a thermal decomposition reaction that occurs under strong heating.

## Law of Conservation of Matter قانون بقاء الطاقة

Matter is neither created nor destroyed, but it change from one form to another.

Chemical Reaction:

| Reactants | Products |
|---|---|
| $C(s)$ – 1 carbon atom | $CO_2(g)$ – 1 carbon atom, 2 oxygen atoms |
| $O_2(g)$ – 2 oxygen atoms | |



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Explanation: In a chemical reaction, the internal elements remain the same. Atoms are not created or destroyed; they are simply rearranged to form new substances. This illustrates the Law of Conservation of Matter.

## Law of Conservation of **Matter** قانون بقاء الطاقة

Matter is neither created nor destroyed, but it change from one form to another.

## Law of Conservation of **Mass** قانون بقاء الكتلة

It is a branch of the Law of Conservation of Matter, formulated by the scientist Antoine Lavoisier:

**A French chemist, philosopher, economist, and biologist**

He was the first to formulate the Law of Conservation of Mass, and the first to prove that oxygen is an essential substance in combustion, and he was the one who named it.

He developed the modern system for naming chemical substances.

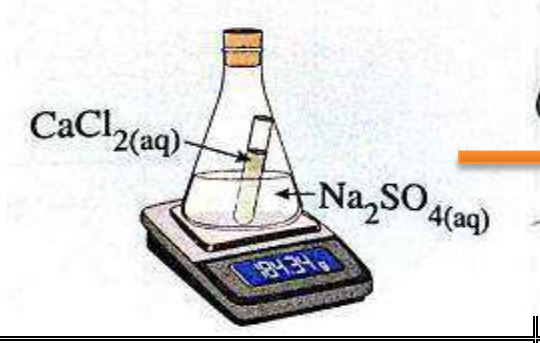
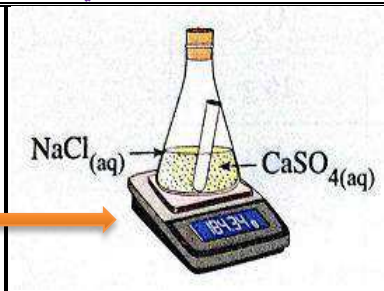
**He is known as the Father of Chemistry** for his emphasis on precise experimentation.

يعرف باسم أبو الكيمياء لتركيزه على التجريب الدقيق.

## Law of Conservation of **Mass** قانون بقاء الكتلة

The total mass of the matter in a chemical reaction is equal to the total mass of the substances produced by the reaction.

الكتلة الكلية للمواد الداخلة في التفاعل الكيميائي تساوي الكتلة الكلية للمواد الناتجة عن التفاعل.

| | | |
|---|---|---|
|  | |  |
| 1-Place a beaker containing sodium sulfate solution, $Na_2SO_4$, on the balance<br>2-Carefully place a test tube containing calcium chloride solution, $CaCl_2$, inside the beaker...<br>Explain? So that the two solutions do not mix<br>3-Close the mouth of the beaker and record its mass with its contents | 4-Invert the beaker. Explain?<br>So that a reaction occurs between the two ..solutions | 5-Re-record the mass of the beaker .after the reaction<br>6-Compare the mass before and after the reaction |



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Observation

The sum of the masses of the substances before the reaction ($CaCl_2$. $Na_2SO_4$) equals the sum of the masses of the substances after the reaction (NaCl, CaSO4

Conclusion

The mass of the reactants does not change despite the occurrence of a chemical reaction accompanied by the formation of a precipitate of calcium sulfate. This indicates that chemical reactions obey the law of conservation of mass

لا تتغير كتلة المواد المتفاعلة رغم حدوث تفاعل كيميائي مصحوب بتكوين راسب من كبريتات الكالسيوم. وهذا يدل على أن التفاعلات الكيميائية تخضع لقانون حفظ الكتلة.

## Law of Conservation of **Mass** قانون بقاء الكتلة

The sum of the masses of the substances entering into a chemical reaction .equals the sum of the masses of the substances resulting from it

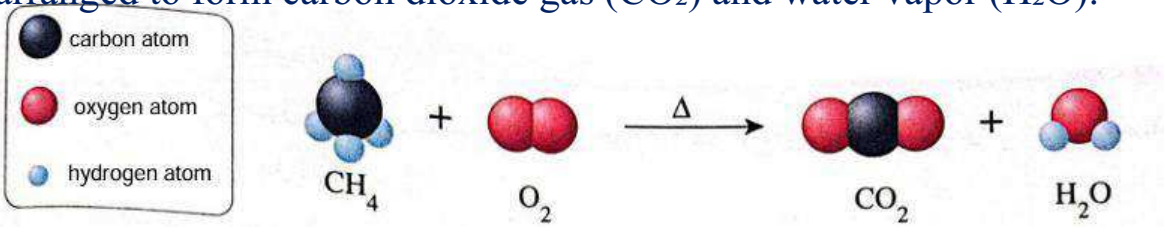
مجموع كتل المواد التي تدخل في تفاعل كيميائي يساوي مجموع كتل المواد الناتجة عنها.

Complete the blanks in the following table

| | reactants | | products | |
|---|---|---|---|---|
| (1) | HgO | | Hg | $O_2$ |
| | 222 g | | ..... | 16 g |
| (2) | Ca | $H_2SO_4$ | $CaSO_4$ | $H_2$ |
| | 20 g | 49 g | 68 g | ..... |
| (3) | $CH_4$ | $O_2$ | $CO_2$ | $H_2O$ |
| | | | 11 g | 9 g |

## Balanced Symbolic Equation

The following diagram represents the combustion reaction of methane gas ($CH_4$) in oxygen gas ($O_2$), in which the atoms of the reactant elements are rearranged to form carbon dioxide gas ($CO_2$) and water vapor ($H_2O$):




It is evident that the equation:

$CH_4 + O_2 \rightarrow CO_2 + H_2O$

Does not satisfy the Law of Conservation of Matter — Why?

Because the number of hydrogen and oxygen atoms on both sides of the equation is not equal.



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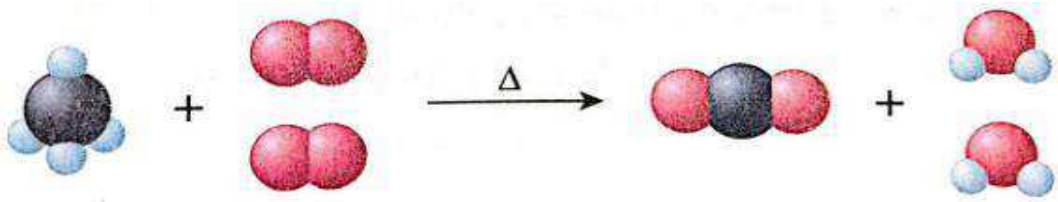
It also does not satisfy the Law of Conservation of Mass - Why?

Because the mass of the reactants does not equal the mass of the products.

When repeating the previous reaction after adding one molecule of oxygen ($O_2$) to the reactants and one molecule of water ($H_2O$) to the products.

كما أنه لا يُحقق قانون حفظ الكتلة - لماذا؟ لأن كتلة المواد المتفاعلة لا تساوي كتلة المواد الناتجة عند تكرار التفاعل السابق بعد إضافة جزيء واحد من الأكسجين ($O_2$) إلى المواد المتفاعلة وجزيء واحد من الماء ($H_2O$) إلى المواد الناتجة.

.




It is clear that the previous diagram represents an equation that satisfies the Law of Conservation of Matter — Why?

Because the number of atoms of each element in the reactants is equal to the number of atoms of the same element in the products.

من الواضح أن المخطط السابق يُمثل معادلة تُحقق قانون حفظ المادة - لماذا؟

لأن عدد ذرات كل عنصر في المواد المتفاعلة يساوي عدد ذرات العنصر نفسه في المواد الناتجة.

The reaction is represented by the following equation:

$CH_2 + 2O_2 \rightarrow CO_2 + 2H_2O$

The numbers in blue are called coefficients المعاملات.

The numbers in green are called subscripts الاعداد التحتية.

This equation is referred to as a balanced symbolic equation.

## Balanced Symbolic Equation

A symbolic chemical equation in which the number of atoms of each element in the reactants is equal to the number of atoms of the same element in the products.

معادلة رمزية متوازنة معادلة كيميائية رمزية يكون فيها عدد ذرات كل عنصر في المتفاعلات مساويًا لعدد ذرات العنصر نفسه في النواتج

### الاعداد التحتية Subscripts

The numbers written below the symbols of the elements in a molecule, representing the number of atoms of each element in one molecule.

الأرقام المكتوبة أسفل رموز العناصر في الجزيء، تمثل عدد ذرات كل عنصر في الجزيء الواحد.

### المعاملات Coefficients

Coefficients The numbers placed before the symbols of elements or molecular formulas of compounds in a balanced symbolic equation.

المعاملات الأرقام الموضوعة قبل رموز العناصر أو الصيغ الجزيئية للمركبات في معادلة رمزية متوازنة.

Coefficients represent the simplest ratio in which reactants combine to form products.

The number 1 is not written for coefficients or subscripts.

In the following reaction: $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

1-How many atoms of each element are present in the reactants and products of this reaction?



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2-What is the total atomic count of the atoms forming the reactants and the products?

3-What is the total number of molecular coefficients for the reactants and products?

| reactants | | |
|---|---|---|
| Fe | O | C |
| 1 × 2 = 2 | 3 + 3 = 6 | 3 × 1 = 3 |

| products | | |
|---|---|---|
| Fe | O | C |
| 2 × 1 = 2 | 3 × 2 = 6 | 3 × 1 = 3 |

Observations

From the answers to the previous question, it is noted that in a balanced symbolic equation:

1-The total number of atoms of each element in the reactants must be equal to the total number of atoms of the same element in the products.

2-The total subscripts of atoms in the reactants do not necessarily have to equal the total subscripts of atoms in the products.

3-The total coefficients of molecules in the reactants do not necessarily have to equal the total coefficients of molecules in the products.

How to Balance a Symbolic Equation

A symbolic equation is balanced by applying the **Law of Conservation of Matter** according to the following steps, as applied to the reaction of nitrogen gas with hydrogen gas to form ammonia gas.

Explanation

**1**

$H_2 + O_2 \longrightarrow H_2O$

Reactant ⟶ products

H 2 balanced 2

O 2 Not balanced 1

**2**

$H_2 + O_2 \longrightarrow 2H_2O$

Reactant ⟶ products

H 2 Not balanced 4

O 2 balanced 2

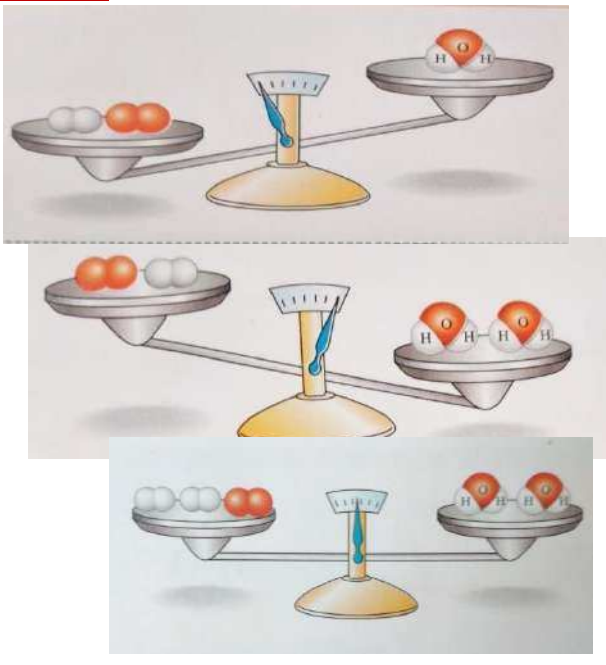
**3**

$2H_2 + O_2 \longrightarrow 2H_2O$

Reactant ⟶ products

H 4 balanced 4

O 2 balanced 2





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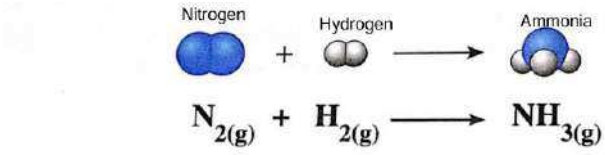
Step 1 Write the correct molecular formulas for both the reactants and the products in the form of a symbolic equation:

$N_2(g) + H_2(g) \rightarrow NH_3(g)$




Step 2

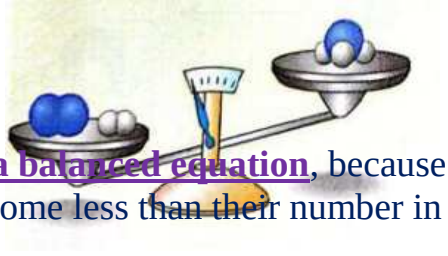
Compare the number of atoms of each element in the reactants with the number of atoms of the same element in the products.

| | | | |
|---|---|---|---|
| N | 2 | ≠ | 1 |
| H | 2 | ≠ | 3 |

**"We find that this equation does not represent a balanced equation**, because the number of atoms of each element in the reactants does not equal the number of atoms of the same element in the products."

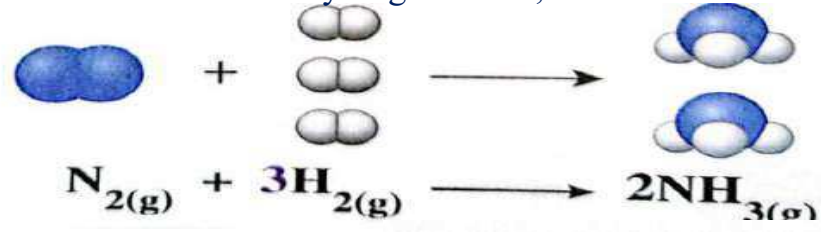
"Step 3: If the numbers of atoms are not equal, one of the coefficients preceding the molecular formulas of the compounds or the element symbols is adjusted, and the process of comparing the numbers of atoms is repeated."

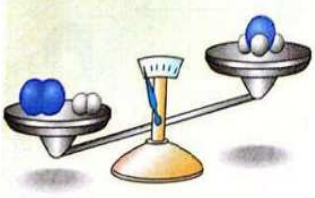
"The coefficient 2 × $NH_3$ is multiplied in order to equalize the number of nitrogen atoms."



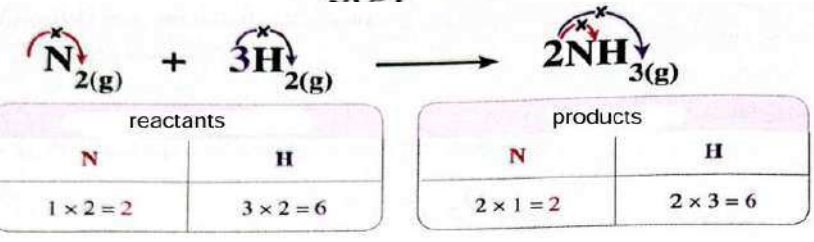
**"We find that this equation does not represent a balanced equation**, because the number of hydrogen atoms in the reactants has become less than their number in the products."

"To equalize the number of hydrogen atoms, the coefficient $H_2$ × 3 is multiplied as follows:"



"Step 4: Verify that the equation is balanced by ensuring that the number of atoms of each element is equal on both sides of the equation."




1) ($N_2 + O_2 \rightarrow N_2O_2$) balancing the equation is not true

Answer: Because balancing is done using coefficients, not subscripts.

2) Balancing the following equation: $Al + O_2 \rightarrow Al_2O_3$

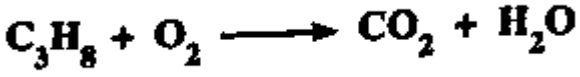
Solution: Balance the number of Al atoms by multiplying the coefficient of Al by 2:

$2Al + O2 \longrightarrow Al_2O_3$

Balance the number of O atoms by multiplying the coefficient of $O_2$ by $\frac{3}{2}$

$2Al + \frac{3}{2}O2 \longrightarrow Al_2O_3$

**3)Balancing the following equation**



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Objective questions

## Unit two, Lesson (2)

### 1- Write Scientific term

1-The symbolic representation of a chemical reaction using symbols and molecular formulas illustrates the ratio between the number of atoms or molecules of the reactants and the products of the reaction. (……)

2-A substance that increases the rate of a chemical reaction without being consumed or altered. (……)

3-The law stating that matter is neither created nor destroyed, but rather transformed from one form to another. (……)

4-The scientist who formulated the Law of Conservation of Matter(……)

5-The law stating that the total mass of the substances involved in a chemical reaction equals the total mass of the products formed. (……)

6-A symbolic chemical equation in which the number of atoms of each element in the reactants equals the number of atoms of the same element in the products. (……)

7-The numbers that precede the symbols of elements or molecular formulas of compounds in the balanced symbolic equation. (……)

8-The numbers written as subscripts below the symbols of the elements in the molecule, representing the number of atoms in a single molecule. (……)

### 2-Complete the following statements appropriately:

1-In a symbolic chemical equation, the abbreviation ……. indicates a substance in the liquid state, while the abbreviation ……. indicates a substance in the form of an aqueous solution.

2-In the equation for heating copper carbonate to obtain ……., the symbol ……. is placed on the reaction arrow, and the symbol ……. is placed at the lower right of the formula $CO_2$.

3-The occurrence of effervescence during a chemical reaction indicates the formation of ……., while the presence of a substance dissolved in water indicates the formation of …….

4-In a symbolic chemical equation, the abbreviation dil. indicates the use of a ……. acid, while the abbreviation conc. indicates the use of a ……. acid.

5-A chemical equation must be …… in order to satisfy the law of ……

6-In a balanced chemical equation, the total mass of the …… substances equals the total mass of the …… substances.

7-In the equation: $PCl_3 + 4H_2O \rightarrow H_3PO_4 + 5HCl$

The total number of subscripts for the atoms of the reactants is ……, while the coefficients of the product molecules are ……

8-Two molecules of ammonia ($NH_3$) are formed when …… molecule(s) of nitrogen ($N_2$) react with …… molecule(s) of hydrogen ($H_2$).


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9-In the unbalanced equation: $C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$
To equalize the number of atoms of H and C, the coefficient of $H_2O$ must be multiplied by $CO_2$, x ……and the coefficient of $H_2O$ x……..

## 3) Place a (✓)and a (✗)with correction:

(1) In a chemical reaction, the atoms of the reactant elements are rearranged to form new products with the same number of atoms of each element. ( )
(2) A symbol is placed between each pair of reactants in a chemical equation. ( )
(3) The symbolic chemical equation uses the abbreviation (g) for a substance in the solid state. ( )
(4) When magnesium reacts with dilute hydrochloric acid, the abbreviation cat is placed on the reaction arrow. ( )
(5) The chemical equation satisfies the Law of Conservation of Energy( ).
(6) The scientist Robert Boyle was given the title "Father of Chemistry." ( )
(7) The mass of a molecule of $CO_2$ is greater than the mass of a molecule of CO. ( )
(8) The total mass of substances before the reaction is always greater than the total mass of substances after the reaction. ( )
9-The numbers preceding the symbols of elements or the molecular formulas of compounds in a balanced equation are known as constants
10-The subscript number of the ammonium group in $NH_4C1$ is 4
11-In the equation: $N_2 + 3H_2 \longrightarrow 2NH_3$ the sum of the subscript numbers of the atoms of the reactants and products is 6
12- In the unbalanced equation $CH_4+O_2 \rightarrow CO_2$ + H2O:
The number of oxygen atoms must be equal, multiplied by a factor of 3× $O_2$

## 4-Choose the correct answer from the given options:

1-The abbreviation (v) is written at the lower right of the molecular formula of a compound that exists in the …… state.
a. Solid b. Liquid c. Vapor d. Aqueous solution
2-What abbreviation is written at the lower right of the molecular formula for an aqueous solution of sodium hydroxide?
a. s b. l c. aq d.g
3-Which equation correctly expresses the physical state of each of the reactants and products in the reaction of adding dilute hydrochloric acid to a magnesium strip?
A) Mg(s) + 2HCl(conc) → MgCl2(aq) + H2(g)
B) Mg(g) + 2HCl(aq) → MgCl2(aq) + H2(s)
C) Mg(s) + 2HCl(aq) → MgCl2(aq) + H2(g)
D) Mg(s) + 2HCl(aq) → MgCl2(s) + H2(s)
4-All of the following describe the reaction 2Mg + O2 --(heat)--> 2MgO, except.....
A) The reaction does not occur without heating
B) The reaction is accompanied by the formation of new bonds.
C). Formation white substance in the end of the reaction .



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D) The mass of the reactants is greater than the mass of the product.

5-Which of the following equations expresses a reaction that is indicated by the evolution of a gas?

A) $AgNO_3 + NaCl \rightarrow NaNO_3 + AgCl$

B) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

C) $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

D) $2Mg + O_2 \rightarrow 2MgO$

6-Which of the following chemical equations satisfies the law of conservation of mass?

A) $N_2 + H_2 \rightarrow NH_3$ B) $NO + O_2 \rightarrow NO_2$

C) $H_2O \rightarrow H_2 + O_2$ D) $KCl + AgNO_3 \rightarrow AgCl + KNO_3$

7-According to the law of conservation of mass, the sum of the masses of the reactants in a chemical reaction is .....

A) double the sum of the masses of the products resulting from it.

B) greater than the sum of the masses of the products resulting from it

C) equals the sum of the masses of the products resulting from it

D) less than the sum of the masses of the products resulting from it

8-Upon the combustion of 12 g of carbon in an atmosphere of oxygen, 44 g of carbon dioxide is formed. What is the mass of oxygen consumed in the combustion?

A) 8 g B) 16 g C) 22 g D) 32 g

9) Which of the following satisfies the law of conservation of mass when heating calcium carbonate ($CaCO_3$) to obtain calcium oxide (CaO) and carbon dioxide ($CO_2$) gas?

| Choices | $CaCO_3$ | CaO | $CO_2$ |
|---|---|---|---|
| A | 100 g | 23 g | 22 g |
| B | 80 g | 56 g | 44 g |
| C | 100 g | 56 g | 44 g |
| D | 80 g | 23 g | 22 g |

10) All of the following equations satisfy the law of conservation of mass, except .....

| choices | Equation |
|---|---|
| A | $4Al + 3O_2 \text{ --}(\Delta)\text{--> } 2Al_2O_3$ |
| B | $C_2H_6 + 7/2\ O_2 \text{ --}(\Delta)\text{--> } 2CO_2 + 3H_2O$ |
| C | $2KClO_3 \text{ --}(\Delta)\text{--> } 2KCl + ⅔3O_2$ |
| D | $4P_4 + 5S_8 \text{ --}(\Delta)\text{--> } 4P_4S_{10}$ |

11) In equation: $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$, what is the sum of the coefficients of the product molecules and the sum of the subscripts of the reactants, respectively?

A) 4, 5 B) 7, 4 C) 4, 7 D) 5, 7

12) In the reaction: $AlCl_3 + 3NaOH \rightarrow Al(OH)_3 + 3NaCl$, what are the numbers of aluminum and sodium atoms participating in this reaction, respectively?

A) 2, 5 B) 5, 3 C) 3, 3 D) 1, 3



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13) Which of the following equations contains 14 oxygen atoms?

A) $NH_4Cl + KOH \rightarrow NH_3 + H_2O + KCl$ B) $2Na + 2H_2O \rightarrow 2NaOH + H_2$

C) $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$ D) $4Fe + 3O_2 \rightarrow 2Fe_2O_3$

14) In the unbalanced equation: $Al + HCl \rightarrow AlCl_3 + H_2$, what is the coefficient of aluminum in the balanced equation?

A) 1 B) 2 C) 3 D) 4

15) When balancing the equation: $PbS + O_2 \rightarrow PbO + SO_2$, the coefficients of oxygen and sulfur dioxide will be ....., respectively.

A) 1, 5 B) 2, 1 C) 3, 2 D) 5, 4

## 5-State the number that represents each of the following

1-The number of oxygen atoms in a molecule of carbon dioxide

2-The number of nitrogen atoms participating in the reaction $6Li + N_2 \rightarrow 2\ Li_3N$

3-The subscript number of sulfur in $2H_2SO_4$

4-The sum of the subscript numbers of the atomic groups in $(NH_4)_2\ SO_4$

5-The sum of the coefficients of the corresponding equation after balancing

$N_2O_5 \rightarrow O_2N_4$

6-The sum of the subscript numbers of the reactants in the opposite equation:

$3KOH + H_3PO_4 \rightarrow K_3PO_4 + 3H_2O$

## 6-Rewrite the following chemical equations after balancing them

1) …..$N_2$ + …..$H_2$ ⟶ ……$NH_3$4

2) ……..$H_2$ + ……..$I_2$ ⟶ …… HI

3) …… Mg +….. $N_2$ ⟶ .....$Mg_3N_2$

4) ……K + …….$Cl_2$ ⟶ …….K Cl

5)…… Ca +……. $O_2$ ⟶ …….Ca O

6)…… Al + …….$Cl_2$ ⟶……$AlCl_3$

7) ……$H_2$ + …….$O_2$ ⟶ .....$H_2O$

8)…….S +…….$O_2$ ⟶ ……..$SO_3$

9)…… $Mg_3N_2$ +…….$H_2O$ ⟶ …….$NH_3$

10) ……..$N_2O_5$ + ……$H_2O$ ⟶ ……..$HNO_3$

11) ……..Al +……..$O_2$ ⟶ ……$Al_2O_3$

12)……$H_2\ SO_4$ + …….KOH⟶ …….$K_2SO_4$ + …….$H_2O$

13) …..$Fe_3O_4$ + ….. $H_2SO_4$ $\xrightarrow{\Delta}$ ……. $Fe_2\ (SO_4\ )_3$ +….. $FeSO_4$ + ……$H_2O$

14) ……C $_3H_8$ + ……$O_2$ ⟶ ……. $CO_2$ + ……..$H_2O$

## Essay questions

### 7. Write the balanced chemical equations expressing the following reactions, including the physical states of the reactants and products:

1-The burning of carbon in oxygen gas to form carbon dioxide.

2-The reaction of sodium with dilute hydrochloric acid to produce a solution of sodium chloride and water, with gas bubbles.



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3-The reaction of silver nitrate solution with sodium chloride solution to form a white precipitate of silver chloride.
4-The reaction of zinc with copper sulfate solution to form a colorless solution and a brown precipitate.
5-The reaction of magnesium with dilute hydrochloric acid to produce a solution of magnesium chloride and hydrogen gas, with gas bubbles.
6-The reaction of barium chloride solution with sulfuric acid solution to form a solution of magnesium chloride and a precipitate of barium sulfate.
7-Reaction of calcium hydroxide solution + nitric acid solution ⟶ calcium nitrate solution + water.
8-The burning of magnesium in oxygen gas to form white magnesium oxide.
9-The union of carbon monoxide with oxygen gas to form carbon dioxide.
Nitrogen + hydrogen ⟶ ammonia
10-The reaction of solid magnesium oxide with water to form a solution of magnesium chloride dissolved in water.
11-Hydrogen sulfide solution + sulfur dioxide gas ⟶ solid sulfur + water.
12-The reaction of calcium phosphate salt with an aqueous solution of sulfuric acid to form a precipitate of calcium sulfate and an aqueous solution of phosphoric acid.
13-The combustion of propane gas ($C_3H_8$) in oxygen to form water vapor and carbon dioxide.
14-Copper nitrate salt --(Δ)⟶ Copper oxide + Nitrogen dioxide gas + Oxygen gas.

## 8. What is meant by each of the following:

1-The Chemical Equation 2- The Symbolic Equation
3-The Law of Conservation of Matter
4-The Catalyst
5-The Law of Conservation of Matter
6-The Law of Conservation of Mass
7-The Balanced Symbolic Equation
5. The Balanced Symbolic Equation
6. The Coefficients in the chemical equation
7. The Subscripts in the chemical equation

## 9. Explain the following:(GR)

1-A chemical equation must be balanced.
2-It is preferable to express a chemical reaction with a balanced symbolic equation rather than with a word equation.
3-The mass of the reactants must be equal to the mass of the products of the reaction.



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# lesson (3) Nutritional Chemistry

-

The bodies of living organisms are composed of various chemical substances, the most important of which is water, along with three groups of organic compounds:
First: Carbohydrates Second: Fats Third: Proteins

**Nutrition Chemistry**
A branch of chemistry that specializes in studying the types of nutrients in food.
كيمياء التغذية فرع من الكيمياء يتخصص في دراسة أنواع العناصر الغذائية الموجودة في الطعام.

## Firstly: Carbohydrates

| Constituent Elements | Its Sources in Food | (Fruit Sources) |
|---|---|---|
| Carbon | Bread | Grapes Apples |
| Hydrogen | Potatoes | |
| Oxygen | Rice | Carbohydrates are the reason for the sweet taste of fruit<br>الكربوهيدرات هي السبب وراء الطعم الحلو للفاكهة |
| | Grains/Cereals | |
| | Vegetables | |

### Classification of Carbohydrates

The following diagram illustrates the classification of carbohydrates according to their chemical structure:

**Carbohydrates**

Are divided into

| Monosaccharides<br>سكريات احادية | Oligosaccharides<br>سكريات محدودة | Polysaccharides<br>سكريات أعديدة |
|---|---|---|
| ↓ | ↓ | ↓ |
| Are: | Consist of: | Consist of: |
| (One)The simplest form of carbohydrates; they cannot be hydrolyzed into simpler units. | From 2 to 10 monosaccharide units. | More than 10 monosaccharide units. |
| ابسط صورة لا يمكن تحللها مائيا لوحدات ابسط | e.g., | e.g., |
| e.g., Glucose - Fructose | Sucrose- Maltose | Starch- Cellulose |


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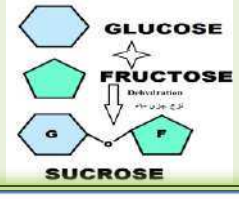
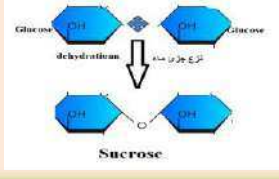
## Disaccharides السكرات الثنائية

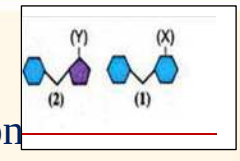
Disaccharides: Oligosaccharides in which each molecule is composed of two monosaccharide units, from which a water molecule has been removed.

سكريات محدودة يتكون كل جزئ من وحدتين من السكريات الاحادية منزوع منها جزئ ماء

### Examples of Disaccharides

| | Sucrose قصب السكر | Maltose سكر الشعير |
|---|---|---|
| Description | **Sucrose (Cane Sugar)**<br>It consists of:<br>• One unit of Glucose (grape sugar).<br>One unit of Fructose (fruit sugar).<br>السكروز (سكر القصب) يتكون من:<br>• جزي واحد من الجلوكوز (سكر العنب).<br>• جزي واحد من الفركتوز (سكر الفاكهة). | **Maltose (Malt Sugar)**<br>It consists of: Two units of Glucose (grape sugar).<br>المالتوز (سكر الشعير) يتكون من: جزيئن من الجلوكوز (سكر العنب). |
| Chemical Reaction | Fructose + Glucose (Dehydration) → Sucrose | Glucose + Glucose (Dehydration) → Maltose |
| |   |   |

The accompanying figure shows the structure of two types of oligosaccharides, (1) and (2):




(1) What is the name of sugar (1) and sugar (2)? with explanation

(2) Identify the name and type of both sugar (X) and sugar (Y).

(3) How do 2 molecules of (X) convert into sugar (1)?

Answer

Sugar (1): Maltose, because it is a disaccharide composed of two identical monosaccharide units.

Sugar (2): Sucrose, because it is a disaccharide composed of two different monosaccharide units

| (2) | (X) | (Y) |
|---|---|---|
| Name | Glucose | Fructose |
| Type | Monosaccharide | Monosaccharide |

3-By a dehydration reaction (the removal of one water molecule).



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Q2: What happens when quantities of carbohydrates are consumed in excess of the body's needs?

س٢: ماذا يحدث عند استهلاك كميات من الكربوهيدرات تفوق احتياجات الجسم؟

A: The excess is stored in: -The liver and muscles in the form of glycogen.
-Body cells in the form of fat.

ج: يُخزَّن الفائض في: - الكبد والعضلات على شكل جليكوجين. - خلايا الجسم على شكل دهون.

B-This stored energy is burned when needed, such as during periods of fasting or when following dietary plans.

تُحرق هذه الطاقة المُخزَّنة عند الحاجة، كما هو الحال أثناء فترات الصيام أو عند اتباع الحميات الغذائية.

## Testing for Glucose

**Reagent Used**: Blue Benedict's Solution. الكاشف المستخدم محلول بندكت الأزرق

**Steps:**

1-Place 2 mL of glucose solutions of different concentrations into 3 test tubes. In a fourth test tube, place the same volume of water.
2-Add 2 mL of Benedict's solution to each test tube.
Heat the test tubes in a water bath for 5 minutes.

**Observation:**

The color of the blue Benedict's solution changes to several different colors with the glucose solutions, while its color remains unchanged with water.

**Conclusion:**

The color of the glucose solution changes upon adding Benedict's solution, corresponding to the concentration of sugar in the solution, as shown in the following table:

| Resulting Color | Red | Orange | Green | Blue |
|---|---|---|---|---|
| Glucose Solution Concentration | High | Medium | Low | None |

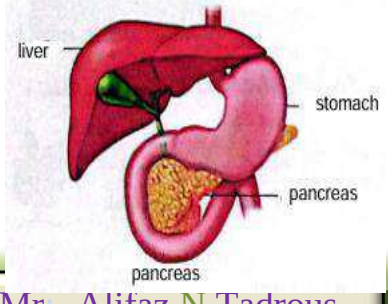
## Integration with Chemistry and Biology

### Diabetes

Cause of the disease:

The accumulation of glucose in the blood as a result of a deficiency in the secretion of the hormone insulin, which is produced by the pancreas.

سبب المرض: تراكم الجلوكوز في الدم نتيجة نقص إفراز هرمون الأنسولين الذي ينتجه البنكرياس.



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**Symptoms of the Diabetes:** 1-Noticeable weight loss.
2- Increased frequency of urination. 3-A constant feeling of thirst.
أعراض المرض 1- فقدان ملحوظ للوزن 2- زيادة في عدد مرات التبول. 3- شعور دائم بالعطش.

Note: Benedict's reagent can be used to determine or suspect a case of diabetes by testing for it in the urine with blue Benedict's solution,

## Testing for Starch

Reagent Used: Yellowish-brown iodine solution.
Process and Observation:
Potatoes contain starch.
The color of the yellowish-brown iodine solution changes to dark blue in the presence of starch.

## Importance of Carbohydrates

There are multiple ways living organisms benefit from carbohydrates, as follows:
(1) Support brain functions (2) A source of energy
(3) Form the cell walls of plants from cellulose
(4) Are a component in the composition of flower nectar.
هناك طرق متعددة تستفيد بها الكائنات الحية من الكربوهيدرات، كما يلي:
(1) دعم وظائف الدماغ (2) مصدر للطاقة (3) تكوين جدران خلايا النباتات من السليلوز (4) دخولها في تركيب رحيق الأزهار.

The benefit of carbohydrates extends to many industries, such as the manufacturing of:
(1) Paper from cellulose
(2) Some cosmetics from sugars and starch (3) Drug capsules.

فوائد الكربوهيدرات تمتد إلى العديد من الصناعات، مثل:
(1) صناعة الورق من السليلوز (2) بعض مستحضرات التجميل من السكريات والنشا (3) كبسولات الأدوية.

Nutritional Awareness: وعي غذائي
It is advised to reduce the intake of carbohydrates found in white sugar and white flour in meals and to rely on whole grains
ينصح بتقليل الكربوهيدرات المتمثلة في السكر الأبيض والدقيق الأبيض في الوجبات والاعتماد على الحبوب الكاملة

Assessment 1
(1) (A) Complete the following statements with the appropriate terms:
(1) Carbohydrates are composed of the elements ....., hydrogen, and .....
(2) .....saccharides consist of 2 to 10 units of ..... sugar.
(3) ..... sugar is composed of one unit of ..... and one unit of fructose.
(4) Cane sugar is known as ....., while malt sugar is known as .....
(B) Reagent (X) was added to two glucose solutions. After heating in a water bath, one turned green and the other turned red:
(1) What is reagent (X)? .....
(2) Compare the concentration of glucose in the two solutions. .....


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(2) (A) Write what each of the following statements indicates:

(1) A polysaccharide found abundantly in potatoes. (.....)

(2) Saccharides composed of more than 10 monosaccharide units. (.....)

(3) The hormone whose deficient secretion causes diabetes. (.....)

(4) The solution used to test for the presence of starch. (.....)

(B) Cellulose is considered a form of carbohydrate:

(1) Mention one industrial importance of cellulose.

.....

(2) What is the importance of cellulose for plants?

.....

## Secondly: Lipids الدهون

| Its Sources in Food | Constituent Elements |
|---|---|
| • Butter | The same elements that make up carbohydrates: |
| • Meats | • C ..... Carbon |
| • Eggs | • H ..... Hydrogen |
| • Milk | • O ..... Oxygen |
| • Many types of nuts | |
| • Vegetable oils | |

Carbohydrates and lipids are essential chemical substances for transporting and storing energy in living organisms.

الكربوهيدرات والدهون هي مواد كيميائية أساسية لنقل وتخزين الطاقة في الكائنات الحية.

Q: Which provides the body with a greater amount of energy: 20g of carbohydrates or 20g of lipids? With an explanation.

A: 20g of lipids, because lipids provide the body with double the amount of energy supplied by carbohydrates.

Medical Awareness

Cholesterol is a fatty matter found with the body's fats.

Cholesterol A fatty matter whose deposition inside arteries leads to their blockage.

الكوليسترول ماده دهنية يؤدى ترسبها داخل الشرايين الي انسدادها

Dangers of Cholesterol:

The deposition of cholesterol inside the arteries leads to their blockage, thus increasing the risk of developing heart disease.

الكوليسترول ماده دهنية يؤدى ترسبها داخل الشرايين الي انسدادها وزيادة مخاطر الإصابة بأمراض القلب



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To maintain a stable, normal level of cholesterol in the blood, it is necessary to consider the following

للمحافظة على مستوى الكوليسترول طبيعي في الدم يجب الاخذ في الاعتبار الاتي :

1-Reduce the intake of fats and fried foods. تقليل تناول الدهون والمقليات

2-Exercise regularly.ممارسة الرياضة بانتظام

3-Drink plenty of water.شرب الماء بكثرة

## Testing for Lipids

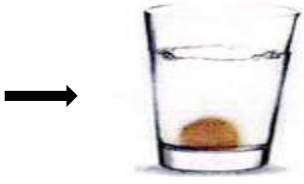
Reagent Used solution4: Orange-Red Sudan

الكاشف المستخدم محلول سودان4 الأحمر

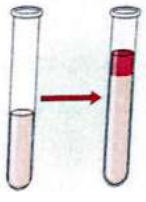
### Steps:

1. Separate the lipid-rich egg yolk from the albumen (egg white).
افصل صفار البيض عن الزلال (البياض)
2. Add the egg yolk to distilled water and stir to create a mixture.
ضع الصفار مع الماء المقطر مع التقليب لتكوين مخلوط
3. To 10 mL of the mixture, add 10 mL of Sudan 4 solution and shake.

Before



After



### Observation:

An orange-**red** color forms on the surface of the mixture.

### Conclusion:

Sudan 4 solution forms an **orange-red color** on the surface of lipid mixtures.

### Q: The following table shows the test results for two samples of mixtures extracted from two foods:

| Sample | Reagent | Iodine Solution | Benedict's Solution | Sudan 4 Solution |
|---|---|---|---|---|
| (1) | | Yellowish-brown | Orange | Orange-red on the surface |
| (2) | | Dark Blue | Blue | Orange-red on the surface |

### Which of the following is correct?

(A) Sample (2) contains only lipids.
(B) Sample (2) contains starch and lipids.
(C) Sample (1) contains starch and glucose.
(D) Sample (1) contains only starch.

- **Explanation:**

Yellowish-brown iodine solution turns dark blue with starch.
Blue Benedict's solution turns various colors (green, orange, or red) with glucose solutions.
Sudan 4 solution forms an orange-red color on the surface of lipid mixtures.

- **Therefore:**

Sample (1) contains glucose and lipids.
Sample (2) contains starch and lipids.
Accordingly, the correct choice is: (B)



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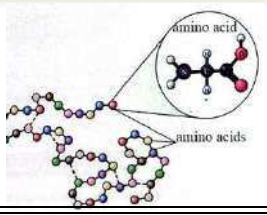
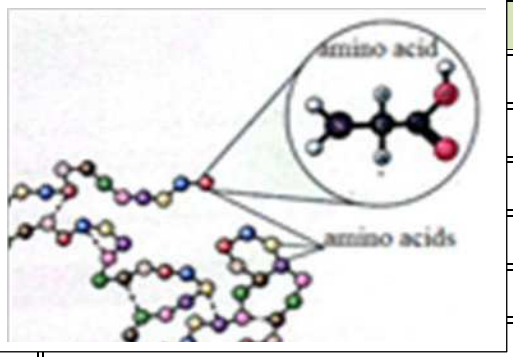
## Thirdly: Proteins البروتينات




are organic chemical compounds composed of basic, water-soluble units called amino acids

البروتينات مركبات كيميائية عضوية تتكون من وحدات أساسية قابلة للذوبان في الماء تسمى الاحماض الامينية

| Its Sources in Food | Constituent Elements العناصر الداخلة في تركيبها | |
|---|---|---|
| Animal proteins, such as: | Essential elements, are: | Non-essential elements such as: |
| • Red meats | C ..... Carbon | P ..... Phosphorus |
| • White meats | H ..... Hydrogen | |
| • Fish | O ..... Oxygen | |
| • Eggs | N ..... Nitrogen | |
| • Milk and its derivatives | --- | |
| Plant proteins, such as: | | |
| • Legumes البقوليات | | |
| • Nuts المكسرات | | |
| • Soybeans فول الصويا | | |
| * Proteins are not considered a primary source of energy. البروتينات لا تعتبر مصدر أساسي للطاقة | | |




Q1: Which of the following plays a role in converting amino acids into proteins?

(A) Antibodies (B) Acids (C) Enzymes (D) Hormones

answer (C): Enzymes act as catalysts in the conversion of amino acids into proteins

أ. تعمل الإنزيمات كمحفزات لتحويل الأحماض الأمينية إلى بروتينات

Q2: Explain: The danger of using dietary supplements containing amino acids for the rapid muscle building.

س2: اشرح: خطورة استخدام المكملات الغذائية التي تحتوي على الأحماض الأمينية لبناء العضلات بسرعة.

A: Because they cause severe risks to the kidneys and liver

ج: لأنها تُسبب مخاطر جسيمة على الكلى والكبد.

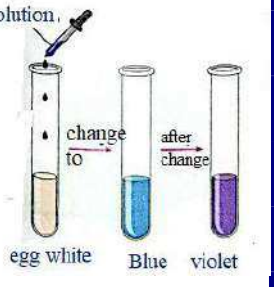
## Testing for Proteins

Reagent Used: Biuret solution (blue in color). الكاشف المستخدم محلول بيوريت الأزرق

Steps: Separate the protein-rich egg albumen (egg white) from the yolk.

Place a portion of the albumen in a test tube.

Add a few drops of Biuret solution to the albumen and shake gently.




Observation:

The color of the blue Biuret solution changes to violet after shaking.

Conclusion: Biuret solution turns violet when added to proteins.

## Importance of Proteins

There are multiple ways living organisms benefit from proteins, as follows:

1-They are involved in building muscles, and in the repair and growth of damaged cells.

2-They are used to form enzymes, which act as catalysts.



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3-They are used to form antibodies that support the immune system's resistance to disease-causing microbes.

The benefit of proteins extends to many industries, such as:

1-The extraction of gelatin, used in food industries, from proteins found in animal bones and hides.

2-The production of insulin, used to treat diabetes, through genetic engineering.

3-The use of enzymes in the production of laundry detergents for stain removal.

## Comparison can be made between carbohydrates, lipids, and proteins

| | Carbohydrates | Lipids | Proteins |
|---|---|---|---|
| 1. Constituent Elements | Carbon, Hydrogen, Oxygen | Carbon, Hydrogen, Oxygen | Carbon, Hydrogen, Oxygen, Nitrogen, and often Phosphorus |
| 2. Food Sources | Bread, potatoes, rice, grains, vegetables, some fruits like grapes and apples | Butter, eggs, milk, meats, many types of nuts, vegetable oils | Meats (red, white), fish, milk and its derivatives, legumes, nuts, soybeans |
| 3. Supplying the Body with Energy | Provides the body with half the energy supplied by lipids. | Provides the body with double the energy supplied by carbohydrates. | Not considered a primary source of energy. |
| 4. Reagents Used for Detection | • Benedict's solution: Turns from blue to green, orange, or red with glucose (depending on concentration). Iodine solution: Yellowish-brown solution turns dark blue with starch. | • Sudan 4 solution: Forms an orange-red color on the surface of lipid mixtures. | • Biuret solution: Blue solution turns violet with proteins. |
| 5. Biological and Industrial Importance | • Source of energy • Supports brain functions • Forms plant cell walls from cellulose • Component in the composition of flower nectar • Manufacture of paper from cellulose • Manufacture of some cosmetics Manufacture of drug capsules. | | • Building muscles, and repairing and growing damaged cells • Forming enzymes • Forming antibodies • Gelatin is extracted from them • Manufacture of insulin • Used in the manufacture of laundry detergents. |



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Objective questions

## Unit two, Lesson (3)

### 1- Write Scientific term

(1) The branch of chemistry concerned with studying the types of nutrients in meals. (……)
(2) The simplest form of carbohydrates. (……)
(3) Saccharides composed of two monosaccharide units. (……)
(4) Saccharides composed of 2 to 10 monosaccharide units. (……)
(5) Saccharides composed of more than 10 monosaccharide units. (……)
(6) The disease resulting from a deficiency in insulin hormone secretion and the accumulation of glucose in the blood. (……)
(7) Polysaccharides that form the walls of plant cells. (……)
(8) An organic nutrient that has the same constituent elements as carbohydrates (……).
(9) A fatty substance whose deposition leads to the blockage of arteries(……..…)
(10) Nutrients that are not considered primary sources of energy. (……)
(11) The element that is found in the composition of proteins but not in the composition of carbohydrates. (……)
(12) Natural proteins used as catalysts. (……)
(13) The branch of science concerned with the production of insulin(……).

### 2-Complete the following statements with the appropriate terms:

(1) Nutrients are classified into ....., lipids, and .....
(2) ..... and ..... are disaccharides.
(3) Cane sugar is known as ....., and it consists of one glucose unit and one ..... unit.
(4) Excess carbohydrates are stored in the liver and ..... in the form of .....
(5) When drops of ..... solution are added to the urine of a person suspected of having diabetes, it turns a ..... color.
(6) Benedict's solution transforms in high-concentration glucose solutions from a ..... color to .....
(7) Adding drops of iodine solution to a slice of potato changes its color to .....
(8) ..... are involved in supporting brain functions and the composition of flower .....
(9) It is advised to reduce the intake of white carbohydrates, such as ..... and ....., and rely on ..... grains.
(10) Paper is made from ....., which is a component of ..... cell walls.
(11) It is possible to maintain a stable cholesterol level in the blood by reducing the intake of ..... and ....., and by regularly .....
(12) Soybeans are rich in ....., while vegetable oils are rich in .....
(13) ..... are composed of the same constituent elements as carbohydrates and



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lipids, in addition to the element .....
(14) Egg albumen is rich in ....., while egg yolk is rich in .....
(15) Proteins are used in the formation of antibodies, which support the ..... system to protect the body from diseases.
(16) Meat, cheese, and eggs are foods rich in both ..... and .....

## 3. Correct the underlined words:

(1) The chemistry of plants is concerned with studying the types of nutrients.
(2) The element sulfur is a fundamental component in the structure of all nutrients.
(3) Glucose is the sugar of fruit.
(4) When a molecule of oxygen is removed from two monosaccharide units, a disaccharide unit is formed.
(5) The color of yellow Benedict's solution changes in glucose solutions according to their concentration
(6) Carbohydrates and lipids are essential substances for the transport and storage of oxygen in cells.
(7) Fatty acids are considered the basic units that make up proteins.

## 4. Place (✓) or (✗)with correction:

(1) Grapes and potatoes are fruits rich in carbohydrates. ( )
(2) Sucrose is a monosaccharide found in grapes. ( )
(3) Excess glucose in the body is stored in the stomach and muscles in the form of glycogen. ( )
(4) The medium concentration of glucose turns orange when the appropriate reagent is added to it. ( )
(5) An increased frequency of urination may be a sign of being affected by insulin-related diabetes. ( )
(6) Drug capsules are made from lipids. ( )
(7) Sudan IV solution forms an orange-red color on the surface of carbohydrates. ( )
(8) Phosphorus may be found in the structure of proteins. ( )
(9) Biuret solution is used to test for proteins found in egg yolk. ( )
(10) Enzymes and antibodies are made of carbohydrates. ( )

## 5. What is the number that indicates the number of:

(1) The essential elements in the composition of carbohydrates.
(2) The monosaccharide units that make up maltose.
(3) The number of water molecules produced from the conversion of 2 glucose units into maltose.
(4) The essential elements in the composition of lipids.
(5) The essential elements in the composition of proteins.



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## 6. Choose the correct answer from the given options:

(1) All of the following are essential nutrients in food meals, except .....
(A) Proteins (B) Fibers (C) Lipids (D) Carbohydrates
(2) Maltose is extracted from .....
(A) Grapes (B) Barley (C) Cane (D) Fruit
(3) Which of the following describes fructose?
(A) It is a monosaccharide. (B) It is a polysaccharide.
(C) It is an oligosaccharide. (D) It is extracted from cane.
(4) ..... are oligosaccharides.
(A) Sucrose and glucose (B) Glucose and fructose
(C) Fructose and maltose (D) Sucrose and maltose
(5) ..... are polysaccharides.
(A) Sucrose and maltose (B) Starch and maltose
(C) Starch and cellulose (D) Cellulose and glucose
(6) Which of the following is correct?
(A) Cane sugar consists of two identical units.
(B) Fructose consists of a number of different units.
(C) Cane sugar consists of many identical units.
(D) Sucrose consists of two different units.
(7) Which of these carbohydrates cannot be hydrolyzed into a simpler form?
(A) Glucose and fructose (B) Glucose and sucrose
(C) Sucrose and maltose (D) Maltose and glucose
(8) Excess glucose in the body is stored in the form of .....
(A) lipids in the muscles. (B) lipids in the body's cells.
(C) proteins in the muscles. (D) proteins in the body's cells.
(9) Iodine solution is used to test for .....
(A) starch. (B) proteins. (C) lipids. (D) glucose.
(10) The accumulation of glucose in the blood is due to .....
(A) an increase in insulin hormone secretion.
(B) a decrease secretion in insulin hormone.
(C) an increase secretion in thyroxin hormone.
(D) a decrease secretion in thyroxin hormone.
(11) With a low concentration of glucose, .....
(A) Benedict's solution turns red. ( B) Biuret solution turns red
(C) Biuret solution turns green. (D) Benedict's solution turns green.
(12) Carbohydrates are used in all of the following, except .....
(A) drug capsules. (B) supporting brain functions.
(C) manufacture of laundry detergents. (D) manufacture of some cosmetics
c)صناعة منظفات الغسيل d)صناعة بعض مستحضرات التجميل



D.M.RAZK موقع الدكتور محمد رزق معلم الكيمياء التعليمي

(13) Foods rich in energy include .....
(A) Water and salts. (B) Lipids and proteins.
(C) Lipids and carbohydrates. (D) Fibers and carbohydrates.
(14) When adding Benedict's solution to glucose solutions of various concentrations, the following colors may form, except .....
(A) orange. (B) green. (C) red. (D) blue.
(15) Eggs are rich in ..... materials.
(A) Fats and fibrous (B) protein and fats
(C) starchy and fats (D) carbohydrate-based and fibrous
(16) Egg yolk is tested for with solution (X) and egg white with solution (Y). Which of the following correctly identifies (X) and (Y)?
(A) (X): Biuret solution, (Y): Sudan IV solution
(B) (X): Benedict's solution, (Y): Iodine solution
(C) (X): Iodine solution, (Y): Benedict's solution
(D) (X): Sudan IV solution, (Y): Biuret solution
(17) An element that can be present in proteins as a non-essential component is .....
(A) Phosphorus. (B) Carbon. (C) Nitrogen. (D) Oxygen.
(18) Soybeans and nuts are considered foods rich in .....
(A) carbohydrates. (B) proteins. (C) lipids. (D) sugars.
(19) The conversion of amino acids into proteins occurs via .....
(A) hormones. (B) antibodies. (C) acids. (D) enzymes.
(20) When solution (X) is added to proteins, the color changes from (Y) to (Z). Which of the following correctly represents (X), (Y), and (Z)?

| Choices | Solution (X) | Color (Y) | Color (Z) |
|---|---|---|---|
| (A) | Benedict | Yellow | Green |
| (B) | Benedict | Blue | Violet |
| (C) | Biuret | Blue | Violet |
| (D) | Biuret | Yellow | Red |

(21) Which of the following expresses the importance of proteins?
(A) Repair and growth of damaged cells.
(B) Supports brain functions.
(C) Source of energy.
(D) Is a component in the composition of flower nectar.
(22) Which of these foods provides the body with the greatest amount of energy?
(A) Grains. (B) Red meats. (C) Oils. (D) Milk.
(23) Which of the following is correct?
(A) Proteins are used in the manufacture of paper.
(B) Gelatin is extracted from the bones and hides of animals.



D.M.RAZK موقع الدكتور محمد رزق معلم الكيمياء التعليمي

(C) Hormones are used in the manufacture of laundry detergents.
(D) Insulin is extracted from muscles.

(24) From the following table:

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| Large Molecules | Cellulose | Oil | Glycogen | Protein |
| Small Molecules | Glucose | Amino acids | Glucose | Ethanol |

Which of the following represents correct pairings of large molecules and the small molecules that compose them?

(A) (1), (2). (B) (1), (3). (C) (2), (3). (D) (3), (4).

(25) Which of these substances necessarily contains nitrogen?

(A) Lipids. (B) Glucose. (C) Proteins. (D) Starch.

## 7-Choose from column (B) what matches column (A), and rewrite the complete statements

| 1 | (A) | (B) |
|---|---|---|
| | 1-Starch consists of | 1-one glucose molecules and one fructose molecule |
| | 2-Maltose consists of | 2- many monosaccharide molecules |
| | 3-Sucrose consists of | 3-many fructose molecules |
| | | 4-two glucose units |

| 2 | (A) | (B) |
|---|---|---|
| | 1-Benedict's | 1- Glucose |
| | 2-Iodine | 2- Fats |
| | 3-Sudan 4 | 3- Proteins |
| | 4-Biuret | 4- Fiber |
| | | 5- Starch |

## Essay questions

8. Identify the odd word out, then state the common link between the rest of the words:

(1) Glucose / Maltose / Fructose.
(2) Sucrose / Maltose / Cellulose.
(3) Cellulose / Starch / Glucose.
(4) Carbon / Hydrogen / Sulfur / Oxygen.
(5) Carbon / Oxygen / Nitrogen / Hydrogen / Sulfur.
(6) Bread / Potatoes / Rice / Meat.

9. What is meant by each of the following:

(1) Nutritional chemistry.
(2) Monosaccharides.
(3) Oligosaccharides.
(4) Disaccharides.



D.M.RAZK موقع الدكتور محمد رزق معلم الكيمياء التعليمي

(5) Polysaccharides.
(6) Cholesterol.

## 10. State one importance for each of the following:

(1) Potatoes in nutrition.
(2) Benedict's solution.
(3) Iodine solution.
(4) Pancreas.
(5) Carbohydrates for the brain.
(6) Carbohydrates for plant cells.
(7) Carbohydrates for flowers.
(8) Carbohydrates for drug manufacturing.
(9) Vegetable oils in nutrition.
(10) Egg yolk in nutrition.
(12) Sudan IV solution.
(13) Meats in nutrition.
(14) Biuret solution.
(15) Enzymes in the manufacture of laundry detergents.
(16) Animal bones in the food industries.

## 11. Explain the following(Give reason):(GR)

(1) Glucose is one of the simplest forms of carbohydrates.
(2) Maltose is a disaccharide.
(3) Starch is a polysaccharide.
(4) Benedict's solution forms several colors with glucose solutions.
(5) Diabetes is caused by a hormonal imbalance.
(6) Iodine solution is used to test for the presence of starch in food.
(7) The constituent elements of carbohydrates and lipids are similar.
(8) The amount of energy that carbohydrates and lipids provide to the body is different.
(9) Cholesterol increases the risk of developing heart disease.
(10) The two components of an egg contain two essential types of nutrients.
(11) Sudan IV solution is used to test for lipids.
(12) People injured in accidents are advised to eat meat.
(13) Not all types of food are considered a source of energy.
(14) Biuret solution is used to test for proteins.
(15) Both Sudan IV solution and Biuret solution give positive results with eggs.

## 12. What happens when:

(1) Consuming quantities of carbohydrates in excess of the body's needs.
(2) Adding Benedict's solution to a solution containing proteins.
(3) Excessive consumption of dietary supplements containing amino acids.



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## 13. How can the presence of each of the following be inferred in liquid food samples:

(1) Glucose sugar.
(2) Starch.
(3) Lipids.
(4) Proteins.

## 14. Miscellaneous Questions:

(1) Carbohydrates are one of the essential nutrients in meals:
(1) Mention three sources of carbohydrates in food meals.
(2) What is the importance of carbohydrates for grapes and apples?
(3) Classify carbohydrates according to their constituent units, mentioning an example for each type.

(2) Potatoes are vegetables rich in nutrients:
(1) What are the essential elements present in potatoes? With an explanation.
(2) What is the effect of adding a few drops of iodine solution to a potato slice? With an explanation.
(3) Which provides the body with a greater amount of energy: 1 g of vegetable oil or 1 g of potato? With an explanation.

(3) The ways of benefiting from carbohydrates are numerous. Mention two ways of benefiting for each of the following:
(1) Humans.
(2) Plants.
(3) Industry.

(4) Glucose and proteins are organic substances found in food:
(1) Compare glucose and proteins in terms of:
* Their essential constituent elements.
* Their sources in food (mentioning two is sufficient).
* Their role as a source of energy.
(2) What is the reagent used to identify each of them in food samples?

(5) Proteins can be from plant or animal sources:
(1) Mention two sources for both plant proteins and animal proteins.
(2) What are the chemical substances that convert proteins into amino acids, and what is the role of these substances in the manufacture of laundry detergents?

(6) The ways of benefiting from proteins are numerous:
(1) What is the importance of proteins for athletes and those with injuries?
(2) What is the role of proteins in resisting microbes?
(3) What is the role that proteins play in the treatment of diabetes?

(7) State the similarities and differences between Benedict's solution and Biuret solution.



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# Guide answer

# For

SCIENCE

# First term

# 2nd prep

**Mr: Alifaz.N. Tadrous**

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Objective questions

## Unit One, Lesson (1)

### 1- Write Scientific term

1-.Matter 2-Fluids 3-Flow 4-Compressibility
5-Diffusion 6-Brownian Motion 7,8- State of Plasma

### 2-Complete the following sentences with appropriate words

1-Gaseous/Liquid 2-Gaseous substances/solids 3-Temperature/Mass
4-Particles of matter/properties 5-Same/Different 6- Movement/Position
7-Very small/Very large 8-Solid/Gases 9- Brownian/Brownian motion
10-Relatively large molecules/fluid particles
11-Positively charged ions/Negative electrons 12-Plasma/Cosmic nebula
13-Disintegration/More pure

### 3-Correct the underlined words

(1) Their viscosity. (2) Liquid/gas. (3) Gaseous. (4) Liquid.
(5) Less than. (6) Smaller than. (7) Fluids

### 4-Put (√ ) and (X) and correct the wrong

(1) (X) A fixed amount that does not change from
(2) (X) Gaseous and liquid materials. (3) (√ )
(4) (X) It decreases with increasing viscosity. (6).(5) (√ )
(7) (X) are symmetrical (9).(8) (√ )
(10) (X) gaseous materials (11) (√ )
(12) (X) solid materials (13) (√ )
(14) (X) in the plasma state.

### 2.Choose the correct answer: )

1- b. 2- c. Water and oxygen

3- d. Water vapor and liquid water 4- c. Ice
5- c. It has no definite shape 6- b. It has a fixed volume and shape
7- c- Sand/ Honey/ Air (8) a. Fixed size 9- a. Mass
10- c. reduce its size (11) a. (X) Air (X) Water
12- b. A liquid substance, because it has a definite volume
13- d. is incompressible 14- d. Diffusion of a substance in a gas
15- a. Very small 16- a. Ice has a definite volume
(17) d. The particles of any material that can be seen with the naked eye
18- d. The intensity of the attractive forces between its molecules
19- c. Both its volume and shape change 20- d. compressibility
21- b. The forces of attraction between their molecules are almost non-existent
22- b. oxygen 23- c. random 24- c. slower and closer together than each other
25- d. Oxygen < oil < wood 26-d- Alcohol/ Ice/ Oxygen
27- b. It is affected by successive collisions with water molecules



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3.Choose the odd word (or phrase) from the following,

| the odd word (or phrase) | The relation between the other words |
|---|---|
| Carbon dioxide | Liquids |
| Wood | Gaseous |
| Slow to diffuse | Properties of gases |
| Has a fixed volume | Properties of liquids |
| Non-diffusionable | Properties of solids |

## Essay Questions

1-What is meant by each of

1-Matter 2-Fluid 3-Flow 5-Compressibility
5-Diffusion 6-Brownian motion 7- Plasma state

2-Give reasons for the following

1-Because they have the ability to flow and take the shape of the pot who contains them
2- The honey flows much more slowly than water due to its higher viscosity The
3- Because their particles are tightly packed and only vibrate in fixed positions
4- Because their particles are loosely packed and can slide past each other, taking the shape of their container
5- Because their particles are far apart and move freely, spreading to fill any container
6-Because the distances between their particles are very large
7-Because the forces of attraction between the particles of the perfume air are very weak and the distances between them are very large, so the perfume particles spread in them
8-as potassium permanganate particles diffuse between the spaces between water particles from high concentration to low concentration at an average speed
9-Because gas particles move in a random and completely free manner in all directions
10-Because the attractive forces between the particles of a solid substance are very strong, while the attractive forces between the particles of a liquid substance are relatively weak
11-Because the attractive forces between its particles are relatively weak.
12-It is difficult to break a piece of rock
13-refers to how well salt dissolves in water to form a saltwater solution.
14-is the process where the scent or smoke particles from the candle spread out and mix with air particles over time

3-What do you notice when

1-shows that gases can be compressed and its volume decrease
2- It will compressibility and distorted
3- the purple color gradually spreads throughout the water by diffusion.
4- The ammonia smell spreads through the air to other parts of the room.
5- sugar can dissolve in liquids to form a solution
6- gases to expand rapidly and increase their kinetic energy



D.M.RAZK موقع الدكتور محمد رزق معلم الكيمياء التعليمي

## Objective questions

## Unit One, Lesson (2)

### 1- Write Scientific term

(1) .(2) Melting Point (3) .(4) Boiling Point 5-Usual atmospheric pressure
6- Sublimation 7-Precipitation 8-Dry Ice

### 2)Complete the following sentences with the appropriate word:

1- 0/100 2-Melting Point/Boiling Point
3- Attraction Forces /intermolecular spaces
4-Atmospheric Pressure/Pureness of the Substance
5- Decreases/Rises 6-100.5ºC-(-1.86ºC)
7-Solid/Liquid 8- Condensation/Freezing
9-Evaporation/Melting 10- Condensation/Precipitation
11- Dew/Clouds 12- Evaporation / Boiling
13- Liquid / Attraction 14- Long / Short
15-Temperature / Humidity - 16-Does not melt / Quickly

### 3)Complete the following chart:

1-Loss 2-Evaporation 3-Water 4-Freezing 5-Gain

### 4) (√)or (X) and correct the wrong :

(1) (X) 100.... (2) (X) When freezing (4), (3) (√)
(5) (X) It differs from the temperature. (6) (X) The higher we go 300m
(7).(8) .(9) (√) (10) (X) It loses heat energy.
(11) (X) It is carbon dioxide. (12) (√)
(13) (X) Decrease in the evaporation rate. . (14) (√)

### 5) Choose the correct answer from the given answers:

(1) c )evaporation and melting
(2) a)steam molecules are farther apart than water molecules
(3) d)They are freed from their fixed positions. (4) (C)C (5) b
6) (C) CD. BC. AB / AB. CD . (7) B)1500°C (8) C)90°C
9) b) The boiling point of the solution increases. (10) C)Chemical processes
(11) d) Freezing 12) c)Freezing 13) C) lost/gained.
(14) D) (X) Gas , (Y) Solid (15) C)Precipitation
(16) d)accompanied by the formation of gas bubbles (17) B) Evaporation
(18) d)Vessel (Y) is slower than vessel (X). (19) C)(Y) > (X) > (Z)
(20) A) (W) (21) C)Humidity

## Essay Questions

### 6)What is meant by:-

1)Melting (2) Boiling point. (3) Sublimation.

(4) Precipitation. (5) Dry ice. (6) Hydrology.


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## 7)Explain the following (give reasons:-:

(1) Because heat energy increases particle movement, leading to melting.
(2) particles gain enough energy to overcome intermolecular forces and escape into air
(3) Because the energy is used to break intermolecular bonds,
(4) Because pure substances have sharp, fixed melting and boiling points,
(5) The boiling point of pure water is lower than 100°C on mountaintops due to decrease atmospheric pressure at high altitudes, so water to boil at a lower temperature.
(6) Because the covered pan traps heat and steam, cooking food faster
(7) Because dissolved substances like glucose raise the boiling point
(8) due to condensation water vapor in the air cools upon contact with the cold surface and turns into liquid.
(9) Because heat from the surroundings causes the ice to melt into liquid water.
(10) Because the temperature is extremely low, below water's freezing point
(11) since freezing reversible, melting, evaporation, reversible condensation
(12) Because it is a slower process that occurs only at the surface and at lower temperatures
(13) Because higher temperatures in summer increase the rate of evaporation
(14) as particles gain more energy to escape the liquid surface more quickly
(15) Because more particles are exposed to air and can escape at once
(16) Because moving air removes evaporated particles faster, allowing more liquid to evaporate.
(17) Because high humidity slows down the evaporation of sweat, reducing the body's ability to cool itself.

## 8)What happens when:

(1) Melting begins The solid transitions into a **liquid**
(2) Evaporation or boiling some particles escape the liquid surface turning into gas
(3) Melting continues until complete at 0°C until all ice becomes liquid water
(4) Boiling point decreases Water boils at a lower temperature
(5) Deposition or condensation followed by freezing Water vapor condense into liquid
(6) Melting or sublimation If air temperature is above 0°C, ice melts. If air is dry and cold, ice may sublime
(7) Sublimation Dry ice (solid $CO_2$) sublimes at −78.5°C, turning directly into gas
(8) Sublimation Iodine transitions directly from solid to purple vapor
(9) Evaporation and drying Water in the syrup evaporates rapidly, leaving behind dry coffee solids—a method used in making instant coffee.



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Objective questions

## Unit One, Lesson (3)

### 1- Write Scientific term

1-The system 2- The surrounding medium 3-The open system
4-The closed system 5-The isolated system 6-The temperature of the system
7-The internal energy of the system 8-The specific heat 9- The radiator

### 2-Complete the following sentences with appropriate words

1-Solid/ Gaseous 2- Open system/Isolated system 3- Open/Closed
4- Closed /Isolated 6-Potential /Kinetic 6- Gaseous/Freely
7- Increases/Rises 8-Solid/ Gaseous 9-increase/Decreases
10-Mass of matter/State of matter 11- Gain/Loss 12-Oil/Water
13-Big/Longer

### 3-Correct underline

1- Closed 2- Closed 3-Temperature 4- decrease
5-Water 6-Less than 7-Engines

### 4-Put a (✓) and an (X) and correct it

1- (X) Exchange of matter and energy with.. 2-(X) Isolated system
(3)(4) (✓) 5-(X) Greater than average
(6)،(7) (✓) 8-(X) The amount of change in 9- (✓)

### 5-Choose the correct answer from the given answer

1- c. Energy is exchanged between them without matter
2- d. Neither matter nor heat is exchanged between them
3-d-(3).(2)
4- b. The mass of the tea does not change in the pot (1). The temperature of the tea decreases in the pot (2)
5- b. Closed
6- a. The potential energy of its particles increases
7- b. Its average kinetic energy increases
8- c. Its shape
9- d. Ball (B), due to its small size
10- d- (1).(3)
11- b. Cube (Y) has less thermal energy than cube (X)
12- a. The water in the two cups has the same amount of heat
13- c. The type of substance of the oil and water
(14) b. Ice is the largest
15- a. Its type of substance
16- a. Water
17- b. Cu
18- b. (B)



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Essay Questions

## 6-What is meant by each of

1-The system 2- The surrounding medium
3-Open system 4-Closed system
5- Isolated system 6- temperature
7-Internal energy of the system 8-Specific heat
9-Radiator

## 7-Give reasons for the following

**1- Because it exchange of both matter and energy between the and medium..**
**2. Because energy exchange only between the system and the surrounding medium**
**3. Because** It exchanges **heat** with the body but **not matter**.
**4- In solids, particles vibrate in place, In gases, particles move freely and rapidly**
5. **Because particle motion slows down**
6. **Because Heat increases the kinetic energy of air molecules**
7. **Because isolated system does not exchange heat or matter with its surroundings.**
8. **Temperature change is inversely proportional to mass**
9. **Because Oil has a lower specific heat capacity than water**
10. **Because Each substance has a unique molecular structure**
11. **Because Mercury expands uniformly with temperature**
12. **Because Water has a high specific heat capacity,**
13. **Because Water has a high specific heat capacity**
14. **Because Water has a high specific heat so it essential for regulating body temperature,**

## 8-What happens when

**1. The kinetic energy of particles increases and raise temperature**
**2. The smaller mass of water heats up faster because it less energy**
**3. Oil heats up faster than water because Oil has lower specific heat capacity**
**4. Water gets hotter, while ice may still be melting during the same heating period.**



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Objective questions

## Unit One, Lesson (4)

### 1- Write Scientific term

1-Heat 2-Thermal Equilibrium 3-Thermal Conductivity
4- Thermal Conductivity 5-Convection 6-Sea Breeze
7- Electromagnetic Waves 8-Thermal Radiation 9-Thermograph

### 2)Complete the following

1-Higher / Lower 2- Convection / Radiation 3- Solid / Conduction
4- Copper / Plastic 5-Wood / Plastic / Metal (Aluminum
6- Diamond / Copper 7-Polystyrene / Fast 8-Collision / Motion
9-Conduction / Convection 10-Low / High 11-Land / Sea
12- Convection / Conduction 13-Convection / Radiation
14-Radiation / Convection / Radiation 15-Thermograph / Thermal

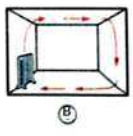
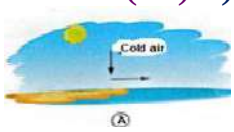
### 3)Correct the underlined:

1-Energy 2-By conduction 3-50ºC
4- Diamonds 5-By convection 6-Summer
7- Thermal 8-By radiation 9- Convection and radiation

### 4)Put ( ✓ ) or (X) , and correct the wrong:

1-( ✓ ) 2- (X) The hotter The colder
3-( ✓ ) 4- (X) The temperature of the water decreases
5-(X) To the hand by conduction
6-(X) When the temperatures are equal 7-( ✓ )
8-(X) Less than 9. 10-( ✓ )
11-(X) Gases and liquids by convection
5-(X) its density increase 13-(X) by conduction

### 5)Choose the correct answer from the given answers:

(1) A)Heat is transferred from the water to the ice.
(2) a)The body loses heat
(3) C)from (X) to (Y) until thermal equilibrium is reached.
(4) **c)Beaker: 70°C , Basin: 70°C** (5) D) Conduction only
(6) a)Convection currents and radiation (7) D) Wood
(8) d)Iron and plastic (9) (A) A
(10) a)Material (X) conducts heat faster than material (Y). (11) c. W>X>Z>Y
(12) b)More conductive than the handle (Y). (13) **A-** 25°C /18°C
(14) D) Aluminum (15) c)Its density decreases and it rises
(16) b)Convection currents above the surface of the tea. (17) b)Hot water rises
(18) b)  (19) a)1<3<2 20) b) 

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(21) b) Material and immaterial media. (22) b) Heating a piece of rock by the sun.
(23) c)The density of a cold liquid is greater than its density when it is hot.
(24) a)Conduction and convection 25)- **B** -Convection and radiation/ radiation

.(1 / 3) . (4 / 2) . (3 / 1) (1)

.(2 / 3) . (3 / 2) . (4 / 1) (2)

26) a) reflect rays 27) (d) radiation only

## 6)Choose between the 2 columns :-

1)1/3 2/4 3/1
2)1/4 2/3 3/2

## Essay Questions

## 7)What is meant by:

(1) Heat (2) Thermal equilibrium (3) Thermal conduction
(4) Thermal conductivity (5) Convection
(6) Sea breeze (7) Radiation (8) Electromagnetic waves

## 8)Give reasons for the following:

**(1)** Because heat flows from the hot iron to the cold solid by conduction, .
**(2)** Because heat transfers from the hot metal to the cold water by conduction and convection,
**(3)** Aluminum good conductor for heat, while wood is a poor conductor, (insulators)
**(4)** Polystyrene is a poor conductor of heat, so it reduces heat loss or gain through the walls
**(5)** Because air is a poor conductor of heat, making them better insulators than solid bricks.
**(6)** to transfer heat away from hot components, preventing overheating and damage .
**(7)** Eagles spreads its wings to rise with the air without having to flap its wings.
**(8)** Because in solids, particles are fixed in position and cannot move only by conduction.
**(9)** Because hot air rises ensures warm air circulates throughout the room.
**(10)** Because cold air sinks allows cold air to fall and cool the lower compartments.
**(11)** Because land heats faster than sea water, cooler sea air to move from sea to land.
**(12)** Because sand has a lower specific heat capacity than water,
**(13)** Because radiation can transfer heat through the vacuum of space,
**(14)** Conduction and convection need matter to transfer heat,
**(15)** Dark clothes absorb infrared radiation in winter; radiation better than shiny white objects
**(16)** Black surfaces absorb more heat from sunlight,
**(17)** Shiny silver surfaces reflect radiant heat, protecting firefighters from high temperatures.
**(18)** Thermograph cameras detect infrared radiation from people's bodies, useful for spotting fevers at airports.
**(19)** Some snakes sense infrared radiation from warm-blooded prey, allowing them to hunt in darkness.

## 9)What happens when:

**(1)** Heat flows from the hot metal block to the colder water until both reach the same
**(2)** No heat transfer occurs because both bodies have the same temperature.
**(3)** Heat transfers from the hotter system to the cooler one until reach the same temperature.



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**(4)** Heat transfers from the hotter drink to the cooler drink, and they reach an intermediate temperature between 70 °C and 20 °C.
**(5)** Heat flows from the hot tea through the spoon by conduction, warming the spoon's handle.
**(6)** Heat moves along the rod by conduction, melting the wax near the heated end first, then farther pins in sequence.
**(7)** The panels reduce heat transfer through the walls because polystyrene is a poor conductor of heat, keeping indoor temperatures more stable.
**(8)** The warm air from the heater stays near the ceiling because hot air rises, so the lower parts of the room remain colder—this is why heaters are better placed near the floor.

Objective questions

## Unit 2, Lesson (1)

### 1- Write Scientific term

1)Physical change 2)Chemical change 3)$CO_2$ gas 4)Chemical reaction
5)silver chloride 6) Soap 7)Iron rusting

### 2-Complete the following:-

1)Physical /chemical 2) reacted /products 3) precipitate /heat
4) sodium bicarbonate /diluted acidic acid 5) bubbles / $CO_2$ gas
6) White /pupil 7) blue / colorless 8)zinc sulphate / copper
9) light /heat 10) don't dissolve / dissolve 11) White /black 12)liquid /solid
13)Oil /sodium hydroxide 14)Egg white /Egg yolk

### 3-Correct the underlined

1)Gas bubbles 2)silver chloride 3) silver chloride 4)blue color
5) sodium hydroxide 6)Iron

### 4-Put a (✓) or (X) and the correction wrong

1) (✓ ) 2) (X)produced on burning wax 3) (✓ ) 4) (X) Chemical change
5) (X)chemical change 6) (✓ ) 7) (X) accompanied by breaking ponds
8) (X) dissolve in water 9) (✓ )

### 5-Choose

1)C 2) C 3) D 4) B 5)C 6)B 7)b 8)b 9)d 10)b
11) c 12) b 13)a 14)d 15) c 16) C 17) a 18) b 19) b

### 6-Define the following terms

**Physical Change:** A change in the state or shape of matter without changing its chemical composition.
**Chemical Change:** A change in the chemical composition of matter, leading to the formation of new substances with different properties from the original substances.
**Chemical Reaction:** Breaking the bonds between the molecules of the reactants and forming new bonds between the atoms of the products.



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## 7-give reason

1) Because it does not change its chemical composition.
2) Because burning wood make a change in structure of matter.
3) Because when water expand it make physical change
4) Due to breaking bonds between atoms of reactants and forming new bonds between products
5) Because a chemical reaction occurs, which results in the formation of hydrogen gas.
6)Because a chemical reaction occurs, which results in the formation of silver chloride, which does not dissolve in water.
7)Because a chemical reaction occurs, which results in the formation of zinc sulphate ,
The blue color of copper sulfate change into colorless solution of zinc sulphate
8)Due to formation of magnesium chloride and forming hydrogen gas
9)Because a chemical reaction occurs, which results in the formation of hydrogen gas.
10) Because white powder is very hot.
11) Because it form new substances with new properties
12)Because a chemical reaction occurs, which results in the formation of caramel.
13)Due to chemical reaction formed which form soap
14)Because a chemical reaction occurs between iron and oxygen in the moist air.

## 8-What do you observe when:

1)Fizzing occurs, and gas bubbles of carbon dioxide rise.
2)A white precipitate forms, which turns violet when exposed to sunlight.
3)A white precipitate forms, which turns violet when exposed to sunlight.
4)A chemical reaction happen and carbon dioxide gas evolves
5)A chemical reaction happen and Hydrogen gas evolves
6)A white powder of magnesium oxide
7)Rust is formed, as it reacts with oxygen in the moist air.
8) A solid black substance (carbon) is formed with dense smoke.
9)Soap will be formed
10)It forms ammonium hydroxide
11) Its color changes to brown

## 9-How can you tell that a chemical reaction has occurred when:

1)Fizzing and the release of carbon dioxide gas.



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2)A white precipitate forms, which turns violet when exposed to sunlight.
3)The blue color of the copper sulfate solution disappears, and the brown copper precipitates on the zinc piece.
4)Gas bubbles of hydrogen gas form.
5)The strip glows brightly, emitting light and heat, and turns into a white powder.
6)It turns black with the emission of smoke and a strong, unpleasant smell.
7)Rust is formed and its color changes.
8)The color and texture of the egg white and yolk change.
9)The liquid mixture turns into solid soap.
10)Its color changes to brown.
11)The emission of light and heat.
12)Limewater becomes turbid
13)Color of litmus paper change into red

## 10-Mention one difference between each of the following (based on what you have studied):

1)Physical change not accompanied by forming new substance , while chemical change forming new substance.
2) Silver chloride don't dissolve in water , magnesium oxide dissolve in water
3) Copper sulfate solution as a blue color , while zinc sulfate solution is colorless
4) Dissolving sugar is Physical change 'while burning sugar chemical change

## Unit two, Lesson (2)

### 1- Write Scientific term

1)Symbolic equation 2)Catalytic agent 3)Law of conservation of matter
4)Antoine Lavoisier 5) Law of mass conservation
6)A balanced Symbolic equation 7) Coefficients 8) subscripts

### 2-Complete the following:-

1)( L) / (aq) 2) Δ /g 3) gas /aqueous solution 4) diluted /concentrated
5) balanced / Law of conservation of matter 6) reactant /products
7) 9/6 8) 1/3 9) 2/ 3

### 3) Place a (✓)and a (✗)with correction:

2) (✓ ) 2) (X) (+ ) Sing 3) (X) in gaseous state 4) (X) dil
5) (X)law of conservation of mass 6) (X) scientist Antoine Lavoisier
7) (✓ ) 8) (X) always equal 9) (X ) coefficients 10) (X )equal 1
11) (X ) product 8 12) (X ) factor 2 x $O_2$

## 5-Choose

1)c 2) C 3) c 4) d 5)b 6)d 7)c 8)d 9)c 10) c
11) d 12)d 13)c 14) b 15) C

## 5-State the number that represents each of the following

1) (2) 2 )(2) 3) (1 ) 4) 3 5) 5 6) 11

## 6-Rewrite the following chemical equations after balancing them:-

1) $N_2 + 3H_2 \longrightarrow 2NH_3$
2) $H_2 + I_2 \longrightarrow 2HI$
3) $3\,Mg + N_2 \longrightarrow Mg_3N_2$
4) $2K + Cl_2 \longrightarrow 2K\,Cl$
5) $2Ca + O_2 \longrightarrow 2Ca\,O$
6) $2\,Al + 3Cl_2 \longrightarrow 2AlCl_3$
7) $2H_2 + O_2 \longrightarrow 2H_2O$
8) $2S + 3O_2 \longrightarrow 2SO_3$
9) $Mg_3N_2 + 3H_2O \longrightarrow 2NH_3$
10) $N_2O_5 + H_2O \longrightarrow 2HNO_3$
11) $4\,Al + 3O_2 \longrightarrow 2Al_2O_3$
12) $H_2SO_4 + 2KOH \longrightarrow K_2SO_4 + 2H_2O$
13) $Fe_3O_4 + 4\,H_2SO_4 \xrightarrow{\Delta} Fe_2(SO_4)_3 + FeSO_4 + 4H_2O$
14) $C_3H_8 + 5O_2 \longrightarrow 3\,CO_2 + 4H_2O$

## 7. Write the balanced chemical equations expressing the following reactions, including the physical states of the reactants and products:

1) $C_{(s)} + 5O_{2\,(g)} \longrightarrow CO_{2\,(g)}$
2) $NaHCO_{3\,s} + HCl_{(aq)} \xrightarrow{dil} NaCl_{aq} + H_2O_{(l)} + CO_{2\,g}$
3) $AgNO_{3(aq)} + NaCl_{(aq)} \longrightarrow Na\,NO_{3(aq)} + AgCl_{(s)}$
4) $Zn_{(s)} + Cu\,SO_{4(aq)} \longrightarrow Zn\,SO_{4(aq)} + Cu_{(s)}$
5) $Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2\,(aq)} + H_{2(g)}$
6) $BaCl_{2\,(aq)} + Mg\,SO_{4(aq)} \longrightarrow MgCl_{2\,(aq)} + Ba\,SO_{4(s)}$
7) $Ca(OH)_{2\,(aq)} + 2\,HNO_{3(aq)} \xrightarrow{dil} Ca(HNO_3)_{2\,(aq)} + 2\,H_2O_{(l)}$
8) $Mg_{(s)} + O_{2(g)} \longrightarrow Mg\,O_{(s)}$
9) $2\,CO_{(g)} + O_{2(g)} \longrightarrow CO_{2\,(g)}$
10) $N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)}$


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11) $Mg\ O_{(s)} + 2HCl_{(aq)} \xrightarrow{dil} MgCl_{2\ (aq)} + H_2O_{(l)}$

12) $2H_2S_{(aq)} + SO_{2\ (g)} \longrightarrow 3\ S_{(s)} + 2\ H_2O_{(l)}$

13) $Ca_3(PO_4)_{2(s)} + 3\ H_2SO_{4(aq)} \longrightarrow 3Ca\ SO_{4(s)} + H_3\ PO_{4(aq)}$

14) $C_3H_{8(g)} + 5O_{2(g)} \xrightarrow{\Delta} 3\ CO_{2(g)} + 4H_2O_{(l)}$

## 9. Explain the following:(GR)

1)To verify low of conservation of mass
2)Because balanced symbolic equation illustrate type and number of elements forming reactants and products.
3)To verify low of conservation of mass

# Unit two, Lesson (3)

## 1- Write Scientific term

(1) Nutritional Chemistry (2) Mono saccharides (3) Disaccharides
(4) Simple Sugars (5) Polysaccharides (6) Diabetes
(7) Cellulose (8) Fats (9) Cholesterol (10) Proteins (11) Nitrogen
(12) Enzymes (13) Genetic Engineering

## 2-Complete the following statements with the appropriate terms:

1) **carbohydrates / proteins** **(2) sucrose / maltose** 3) **sucrose / fructose**
**(4) muscles / glycogen** **5) Benedict's reagent / diabetes** **6) blue / red**
**7)brown yellow/dark blue** **8) carbohydrates /nectar** **9) White sugar/ white flour**
**10) cellulose / walls** **11)fats /fried food** **12) proteic /fatty** **13) protein /nitrogen**
**14) proteic /fatty** **15)Immunity** **16) proteic /fatty**

## 3. Correct the underlined words:

**1) nutrition 2)carbon 3) fructose 4) water 5)blue 6)energy 7) amino**

## 4. Place (✓) or (✗)with correction:

1) (X ) grabs and apple 2) (X ) glucose 3) (X ) Liver and muscles
4) (✓ ) 5) (X ) **diabetes** 6) (X ) from carbohydrates 7) (X ) fats surface
8) (✓ ) 9) (X ) egg white 10) (X ) from proteins

## 5. What is the number that indicates the number of:

1) 3 2) 2 3)1 4)3 5)4

## 6. Choose the correct answer from the given options:

1)b 2) b 3) a 4) d 5)c 6)d 7)a 8)b 9)a 10) b



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11) d 12)c 13)b 14) d 15) b 16) d 17)a 18)b 19) d 20)c
21) a 22)c 23)b 24)b 25)c

## 7-Choose from column (B) what matches column (A), and rewrite the complete statements

1) ( 1/2) , (4/2) , (1/3) 2)(1/1) , (2/5) , (3/2), (4/3)

## 8. Identify the odd word out, then state the common link between the rest of the words:

| Unsuitable word | What join words together |
|---|---|
| (1) Maltose | 1)monosaccharide |
| (2) Cellulose | 2) disaccharide |
| (3) Glucose | 3) polysaccharide |
| (4) sulphur | 4)building blocks of fats and carbohydrates |
| (5) sulphur | 5) building blocks of proteins |
| (6) meat | 6)sources rich with carbohydrates |

## 9. What is meant by each of the following:

| | meaning |
|---|---|
| (1) Nutritional chemistry. | 1) A branch of chemistry that specializes in studying the types of nutrients in food. |
| (2) Mono saccharides. | 2) The simplest form of carbohydrates; they cannot be hydrolyzed into simpler units. |
| (3) Oligosaccharides. | 3) A type of carbohydrates formed from 2: 10 monosaccharide units |
| (4) Disaccharides. | 4)Oligosaccharides in which each molecule is composed of two monosaccharide units, from which a water molecule has been removed |
| (5) Polysaccharides. | 5) A type of carbohydrates formed from more than 20 monosaccharide units |
| (6) Cholesterol. | 6)A fatty substance whose deposition inside arteries leads to their blockage. |



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## 11. Explain the following(Give reason):(GR)

1)Because it cannot be broken down into something simpler than it is.

2)Because its units is composed of two glucose units.

3) Because its smallest unit is composed of many glucose units

4)Because the formed color depends on the concentration of glucose sugar.

5)Because Diabetes caused due to lack of insulin hormone

6)Because the yellow brown color of iodine change into dark blue color when it find starch

7)Because both are formed from carbon , hydrogen and oxygen

8)Because lipids provide the body with double amount of energy we can get it from carbohydrates

9) Because Cholesterol precipitate inside arteries and block them

10)Because egg yolk contain fats and egg white contains proteins.

11)Because it forms a red orange color on the surface of lipids

12)Because meat provide the cells with protein needed to help the damage cells to repair and grow

13)Because protein don't provide the body with energy.

14) Because Biuret color change from blue to violet when it find protein

15)Because egg yolk contain fats and egg white contains proteins.

## 12. What happens when:

1) Part of it stored in muscles and liver in the form of glycogen and another part stored in body cells in the form of fats (lipids)

2) Its blue color doesn't change

3)Kidney and liver may damage



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